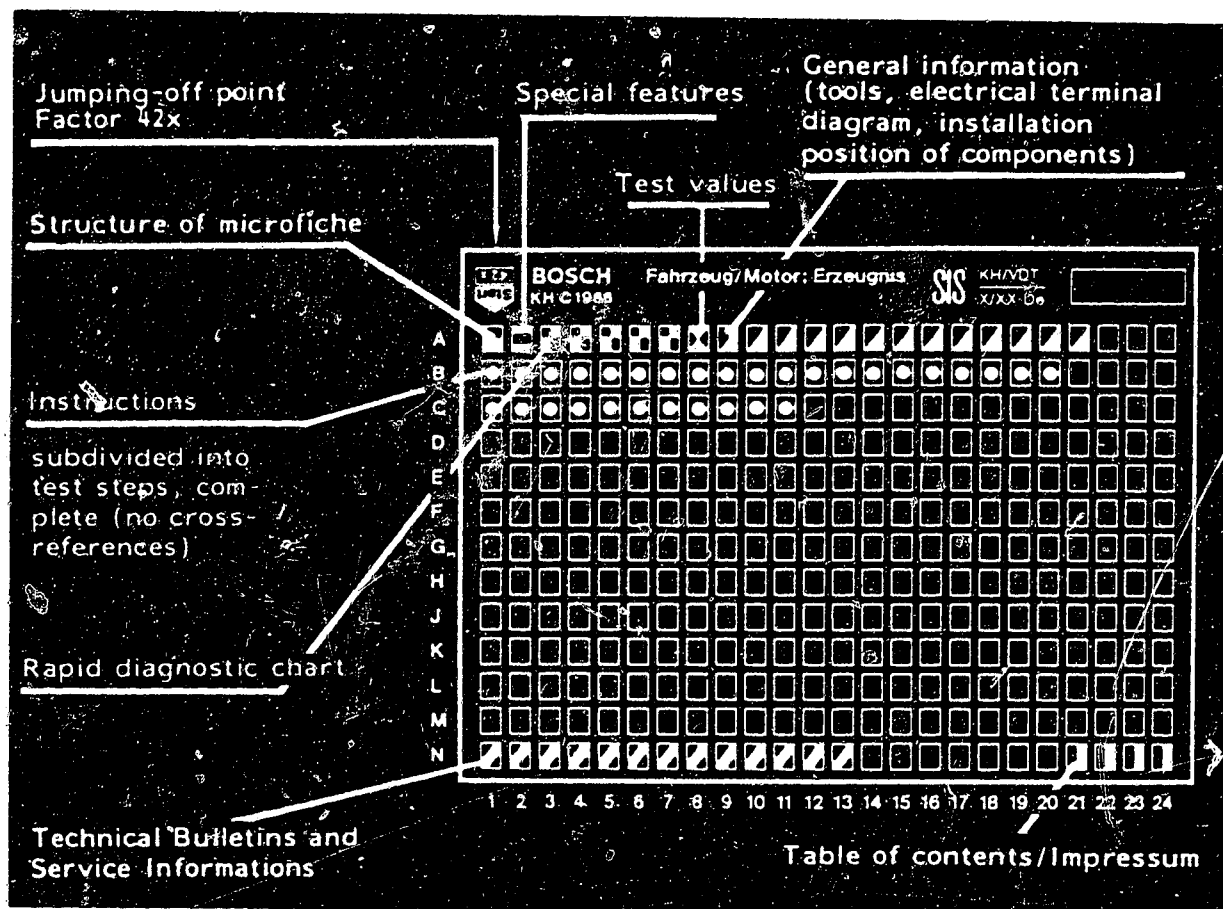


Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

E16	Product/component/test step
	Vehicle/engine

Coordinate

3. Limits of section



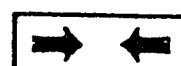
Beginning



Mid-section



End



One-page section

4. References to relevant test steps in test specifications; coordinate e.g. C6

C6

A1	Trouble-shooting program	↓
-----------	--------------------------	---

1. Special features

This microcard deals with the VW vehicle models with breakerless transistorized ignition (TI-H)

VW Transporter, Scirocco as of 8.79

VW Golf, Jetta, Passat as of 7.80

VW Iltis as of 8.80

VW Santana as of 9.81

VW Polo as of 8.85

Trigger box 0 227 100 100, .. 103, .. 137 (with current limitation) or Fairchild trigger box (Volkswagen service part) ignition coil 0 221 122 023, ... 349



2. Rapid diagnosis chart

The rapid diagnosis chart starting on Coordinate A4 makes it possible for the experienced expert to quickly check the ignition system using the necessary test equipment/auxiliaries.

The rapid diagnosis chart contains the sequence of test steps, cause of trouble, test instructions and coordinate references.

How to use the rapid diagnosis chart

The rapid diagnosis chart starting on Coordinate A4 is to be used if there is a primary signal/ignition spark. The rapid diagnosis chart starting on Coordinate A6 is to be used if there is no primary signal/ignition spark.

If detailed instructions and information are required, always proceed according to the trouble-shooting program starting on Coordinate B7.

Conditions for testing

Battery fully charged, fuel system O.K., engine mechanically O.K. (e.g. compression, valve clearance etc.).

Ambient temperature/temperature of ignition system 0° to 100° C (temperature has a considerable effect on measured values).

Ignition must be off before disconnecting plug connectors.



Rapid diagnosis chart

Primary signal/ignition spark present

Test step	Possible cause of trouble	Test instructions	Test specifications	Coordinates
1	High-tension side	Visual inspection e.g. of ignition harness, distributor cap etc Continuity check, ignition oscilloscope pattern	--	--
2	Ignition coil	Visual inspection: plug present; sealing compound escaped? Electrical test Primary term. 1 and term. 15 Secondary term. 1 and term. 4	0.5 ... 0.9 Ω 2.5 ... 4.4 k Ω	B 12
3*	Contact resistances	Check for contact resistances in power-supply leads of trigger box/primary circuit.	max. 0.3 Ω	B 14
4	Ignition-timing adjustment	Adjust ignition. If applicable, jump DLS unit plug.	Autodata test specifications	--
5	Trigger box power supply	Engine idling. Voltage at trigger-box plug term. 4 (+) and term. 2 (-)	12 ... 14 V max. 1 V below U_B	B 16
6	Ignition coil power supply	Engine idling. Voltage at ignition coil term. 15 to negative battery terminal.	min. 10 V	B 16
7	Peak-coil-current cut-off	Ignition ON. Voltage at ignition coil term. 15 and term. 1. Trigger wheel fully in air gap.	approx. 1s approx. 5 V then 0 V	B 18
8	Primary voltage	Engine idling. Measure primary voltage.	340 ... 390 V	B 18

* Perform only if engine not running.

A4

Rapid diagnosis chart
Volkswagen



A5

Rapid diagnosis chart
Volkswagen



Rapid diagnosis chart

Primary signal/ignition spark not present

Test step	Possible cause of trouble	Test instructions	Test specifications	Coordinates
1	Trigger box power supply	Ignition ON. Voltage at trigger-box plug term. 4 (+) and term. 2 (-)	Battery voltage	C 1
2	Primary circuit power supply	Ignition ON. Voltage at trigger-box plug term. 1 (+) and term. 2 (-)	Battery voltage	C 1
3	Ignition pulse generator voltage and control leads	Check leads from trigger box to ignition distributor for continuity. Ignition-distributor plug term. 3 and trigger-box plug term. 3 Ignition-distributor plug term. 5 and trigger-box plug term. 5 Ignition-distributor plug term. 6 and trigger-box plug term. 6	approx. 0 Ω	C 3
	Ignition pulse generator power supply	Ignition ON Voltage at ignition-distributor plug term. 5 (-) and term. 3 (+)	min. 10 V	C 5
	Operation of ignition pulse generator	Start engine. Signal at term. 6 of ignition-distributor plug	Rectangular pulse	C 7
4	Ignition coil	Visual inspection: plug present; sealing compound escaped? Electrical test primary term. 1 and term. 15 secondary term. 1 and term. 4	0.5 ... 0.9 Ω 2.5 ... 4.4 k Ω	C 9

A6

Rapid diagnosis chart
Volkswagen



A7

Rapid diagnosis chart
Volkswagen



3. Test specifications

Ignition coil, primary 0.5...0.9 Ω

Ignition coil, secondary 2.5...4.4 k Ω

B 12

Trigger box power supply

12...14 V
max. 1 V below
battery voltage

Ignition coil

> 10 V

B 16

Peak-coil-current cut-off
approx. 1 s
then

approx. 5 V
0 V

Primary voltage with engine idling
(Connect pulse shaper)

340...390 V

B 18

Ignition pulse generator power
supply with ignition on

> 10 V

C 5

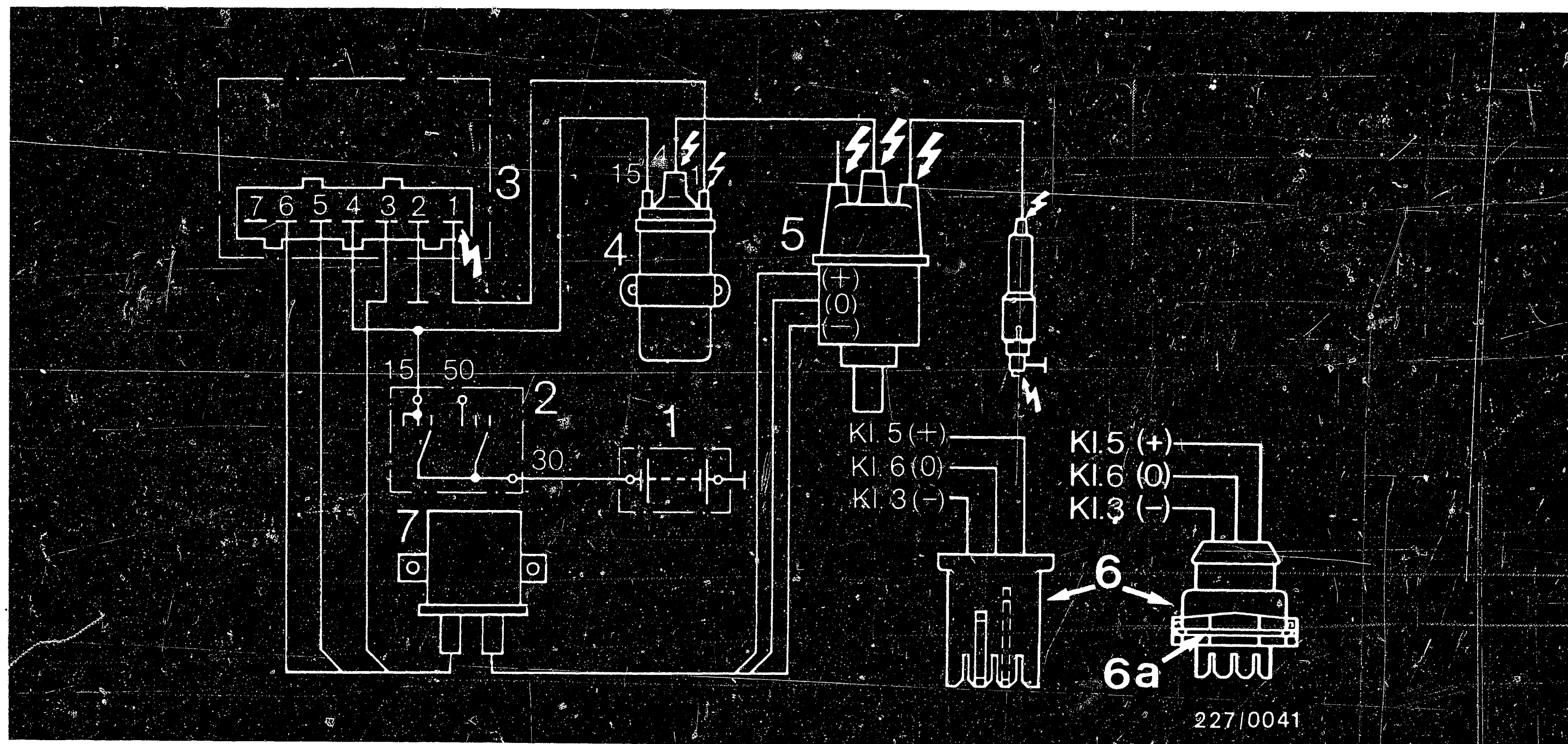
See Autodata test specifications for settings for
ignition, idle speed, exhaust gas, valve clearance etc.

A 8

Test specifications

Volkswagen





- 1 = Battery
- 2 = Ignition/starting switch
- 3 = Trigger box
- 4 = Ignition coil
- 5 = Ignition distributor

- 6 = Ignition-distributor connector
left - old version with guide lugs
right - new version
- 6a = Wire retainer
- 7 = DLS unit
- Danger arrows = Dangerous voltage

4. Electrical terminal diagram

A9

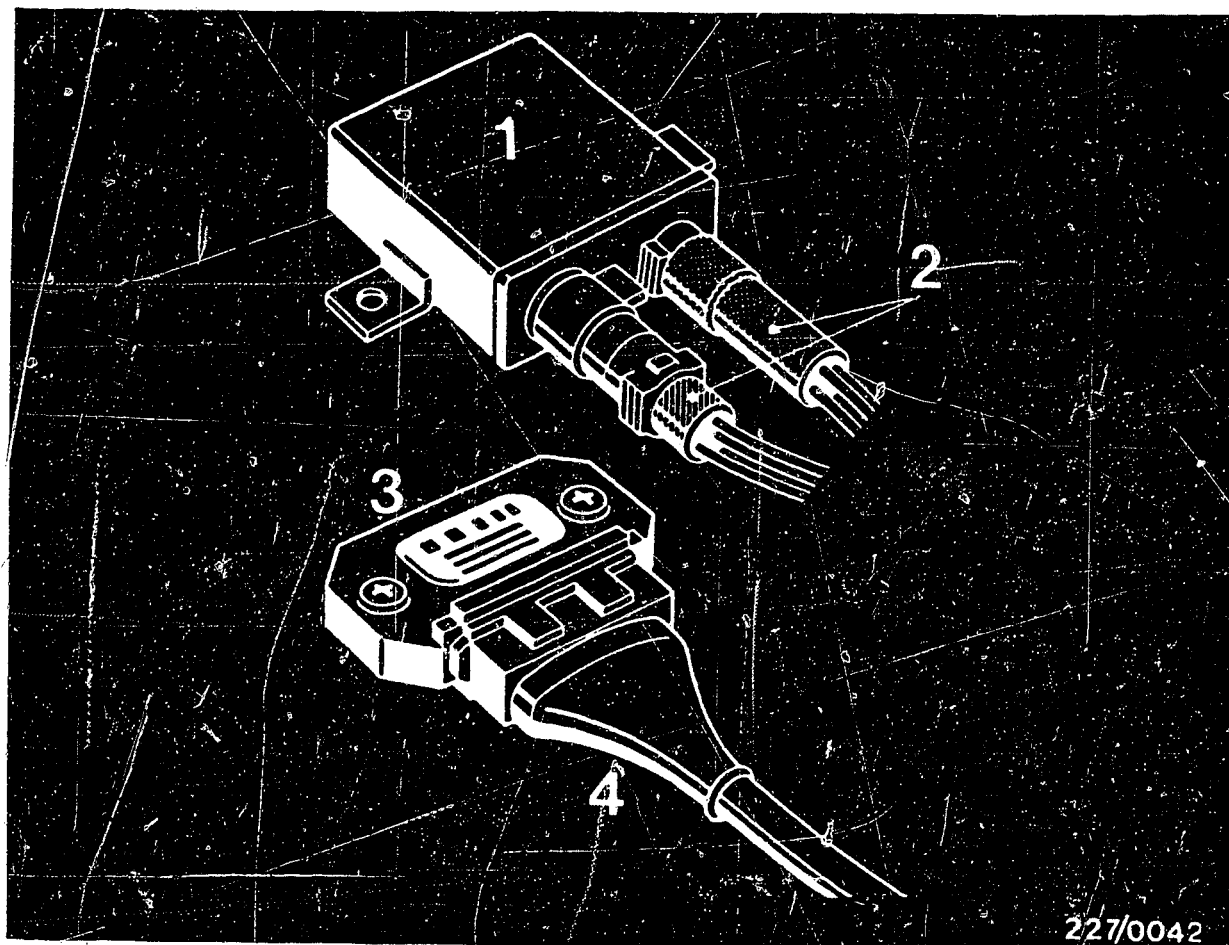
Electrical terminal diagram
Volkswagen



A10

Electrical terminal diagram
Volkswagen





227/0042

- 1 = DLS unit
- 2 = DLS connector
- 3 = TI-H trigger box
- 4 = Trigger-box plug

5. Installation position of components

Polo, Scirocco, Golf, Jetta, Passat, Santana.
Trigger box and, if applicable, DLS unit are in the engine compartment under the water-box cover (near wiper motor)

Iltis:

Trigger box is on engine firewall on left-hand side in forward direction of travel (behind windshield washer reservoir).

VW transporter:

Trigger box and, if applicable, DLS unit are in the engine compartment, on the left-hand side in the forward direction of travel.



6. Necessary test equipment, auxiliaries

Motortester e.g.	MOT 201	0 684 000 201
Spark gap e.g.		
Ignition coil/ condenser tester	EFAW 106 A	0 681 100 001
or single spark gap	EF 1177/7	1 684 531 000
Sleeve-type suppressor 5 kΩ		0 356 500 001
Ohmmeter	ETE 014.00	0 684 101 400
or e.g.	Pontavi Wh2	commercially available
Voltmeter e.g.	ETE 014.00	0 684 101 400
Pulse shaper (needed for measuring the primary voltage with MOT 201, 202, 400)		1 684 463 154
Test prods		
red		1 684 485 035
black		1 684 485 034
Test leads (for correct connection of test equipment at connectors)	KDZS 0004 ... 0005	
Thermal conduction paste		5 942 860 003
Vacuum pump e.g. from Fa. Korinth Ludwig-Kloos-Str. 21 6450 Hanau 7 - Steinheim	Mityvac	commercially available



7. Danger of accident on electronic ignition systems

Increased demands of modern engines on the ignition system combined with the desire for freedom of maintenance have recently led to electronic ignition systems being fitted as standard. Usually the ignition power of electronic systems (of almost all manufacturers) is higher than that of conventional systems, and there are signs of further increases in power. Electronic ignition systems thus reach a power range which can be highly dangerous if live parts or terminals are touched (both on the primary as well as the secondary sides).

In this connection we should like to point out that the VDE regulations, in particular VDE 0104/7.67 and/or the respective national regulations must be followed when testing or working on the ignition system.

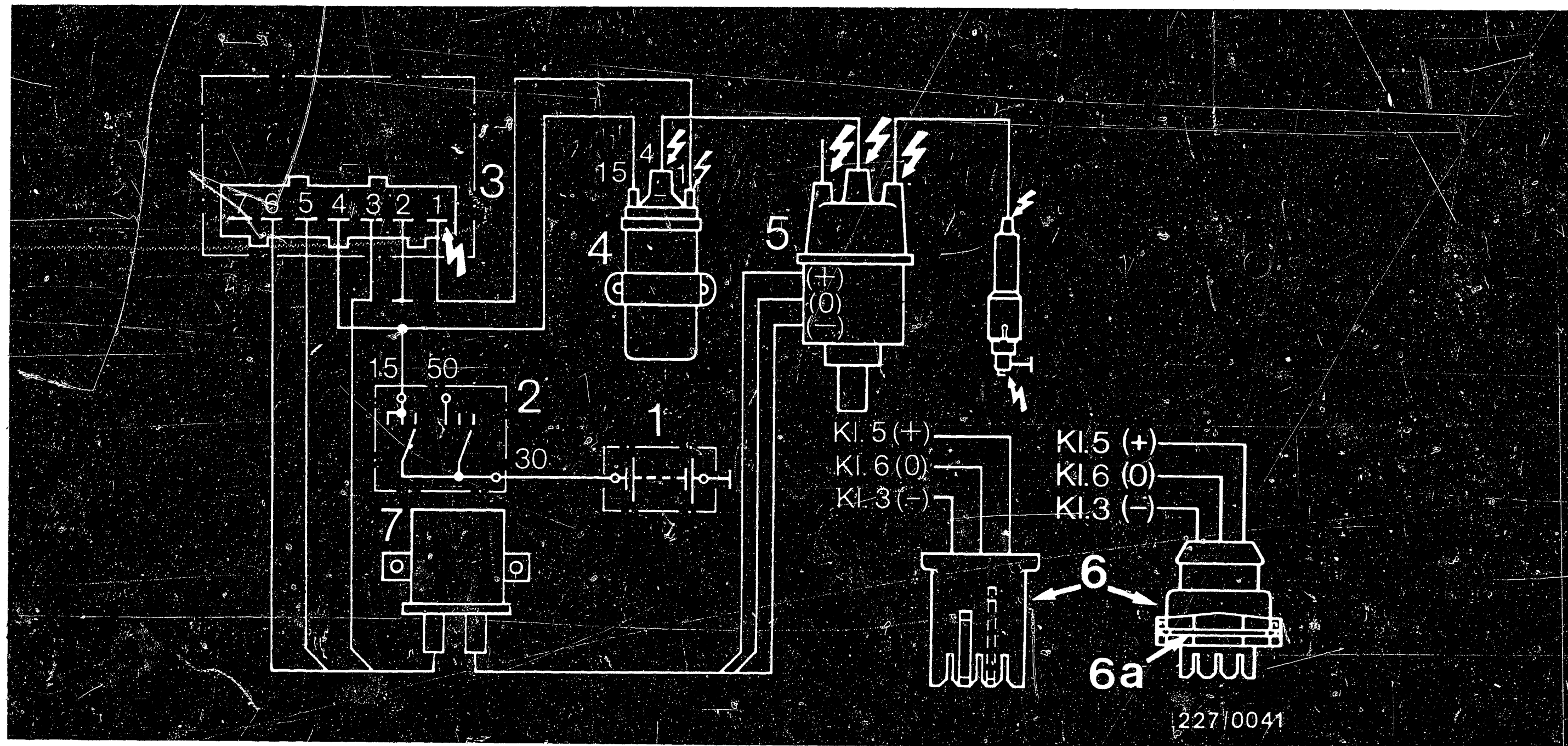
The ignition should always be switched off when working on the ignition system (switch off ignition or voltage source). Such work includes:

- Connecting of engine test equipment (timing light, dwell-tach tester, ignition oscilloscope, etc.).
- Replacing parts of the ignition system (spark plug, ignition coil, ignition distributor, H.T. ignition cable, etc.).

If, when checking the ignition system/when performing adjustment operations on the engine (e.g. mixture preparation), it becomes necessary to switch on the ignition (switch on ignition/voltage source), the above-mentioned dangerous voltages occur throughout the entire system.

The danger of accident exists, therefore, not only on the individual assemblies of the ignition system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also on the wiring harness (e.g. tachometer connection, diagnostic plug), at plug-in connections and test equipment.





- 1 = Battery
- 2 = Ignition/starting switch
- 3 = Trigger box
- 4 = Ignition coil
- 5 = Ignition distributor

- 6 = Ignition-distributor connector
left - old version with guide lugs
right - new version
- 6a = Wire retainer
- 7 = DLS unit

Danger arrows = Dangerous voltages (400V-25 kV).

Danger of accident

The dangerous locations are identified by danger arrows taking the example of the terminal diagram of an electronic ignition system.

A14

Danger of accident
Volkswagen



A15

Danger of accident
Volkswagen



8. Incorrect indication of engine speed, dwell angle and ignition point

On ignition systems with trigger boxes 0 227 100 100, ... 103, ... 137 and those of Fairchild (TI-H) with current limitation, there may be an incorrect indication of engine speed, dwell angle and ignition point.

See Coordinates L8 - L13 for further details.

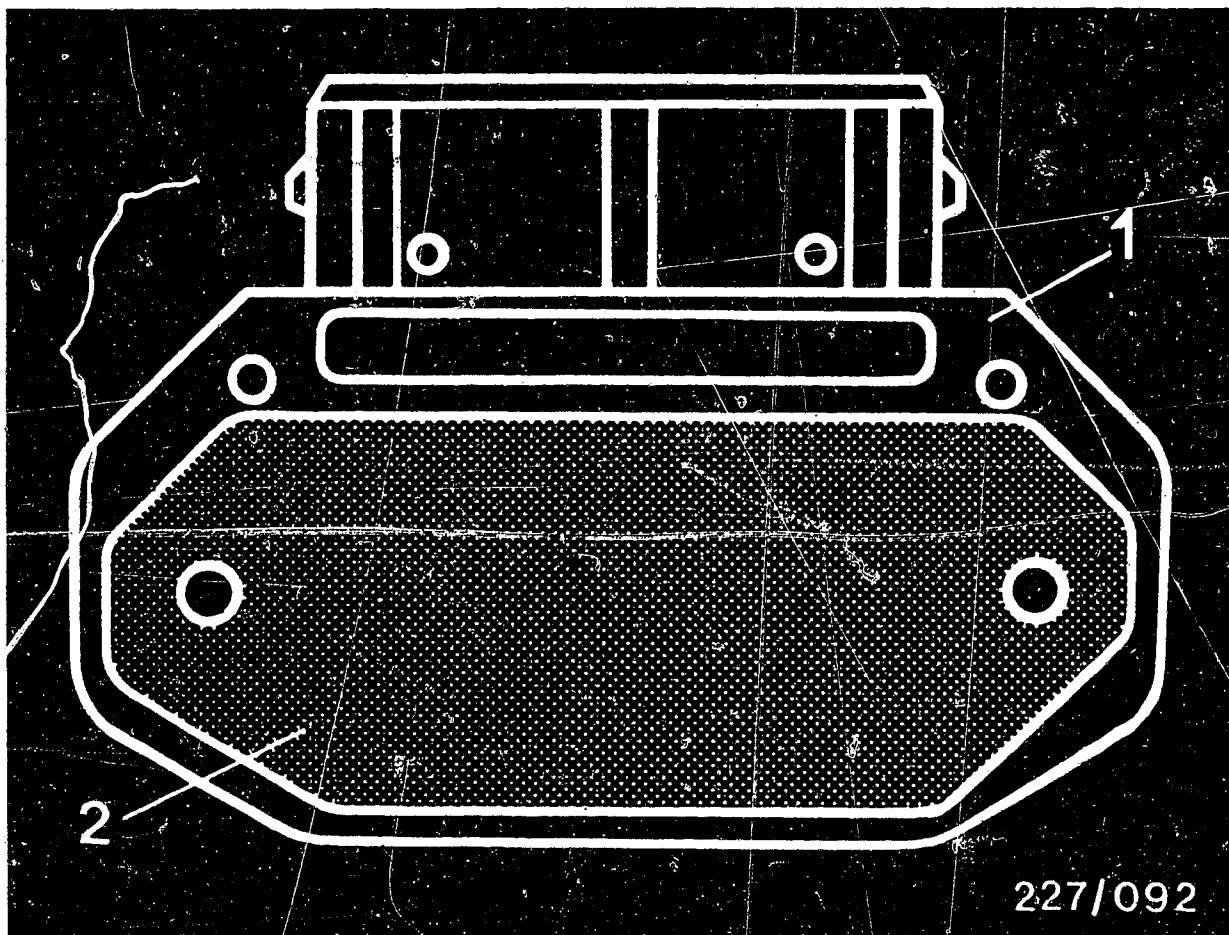


9. Important vehicle information

- DLS unit: This ignition system may additionally be equipped with a DLS unit (digital idle stabilization) (Volkswagen service part). The DLS is installed in the line between ignition pulse generator and TI-H trigger box and stabilizes the idle speed by advancing the ignition timing. The DLS operates only in the engine-speed range between 600 and 940 min^{-1} , or between 600 and 840 min^{-1} in the case of Passat and Santana with 1.9 l engine. In this range, the ignition timing is triggered no longer by the ignition pulse generator but by the DLS unit. At all other engine speeds the DLS is inoperative. Since ignition timing and idle speed are changed by the DLS, render the DLS inoperative before any testing and adjusting operations (e.g. adjusting of ignition timing, exhaust gas and idle).
- Resistance measurements must only be performed with the ignition switched off or with the battery disconnected (measuring instrument defective).
- When testing compression, remove the trigger-box plug or firmly ground ignition coil terminal 4 using auxiliary cable (dangerous high voltage, insulation damage to ignition coil, ignition distributor, ignition harness).

Note: Auxiliary cable must have at least 2 k Ω interference suppression, e.g. sleeve-type suppressor (5 k Ω) 0 356 500 001.

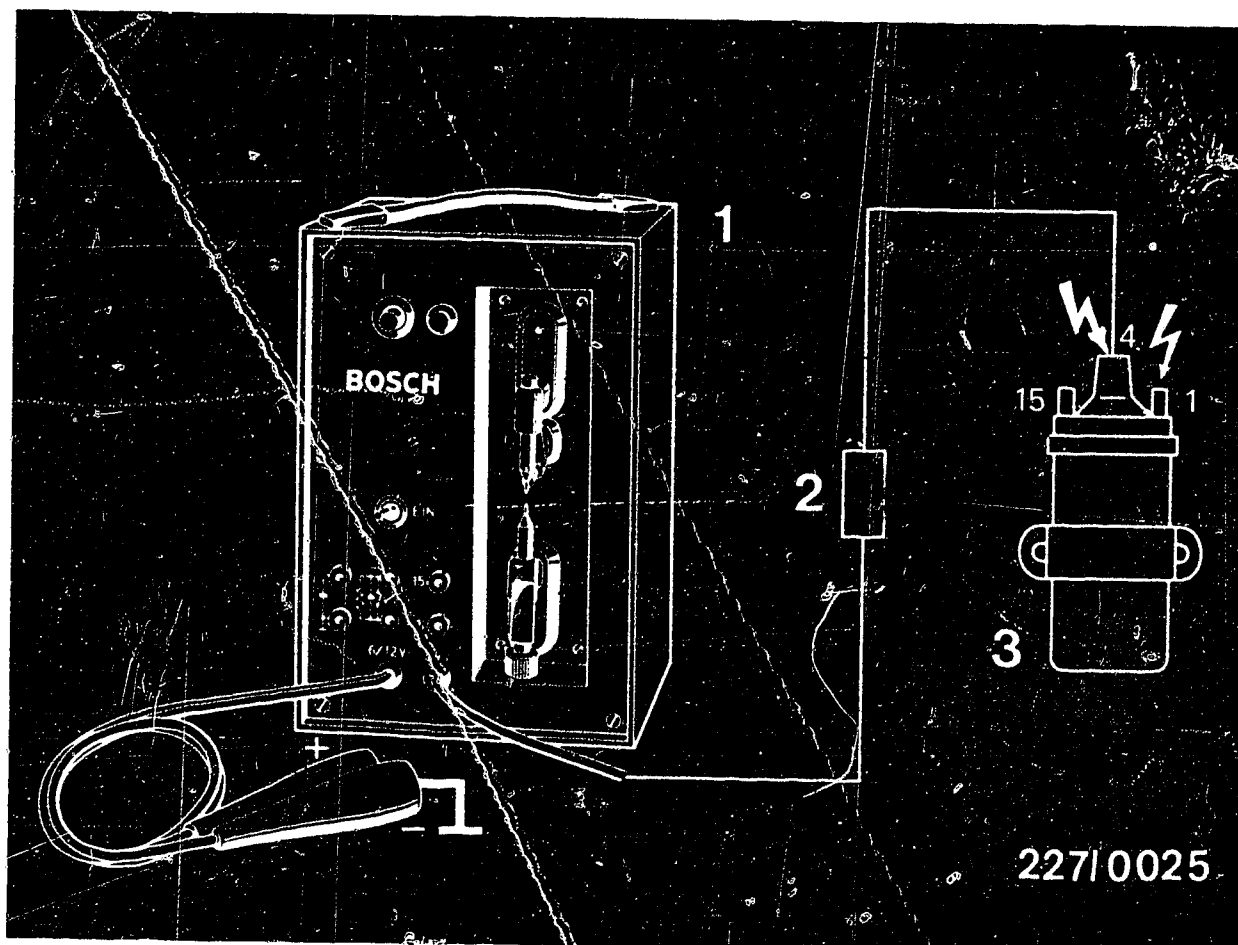




227/092

1 = Trigger box
2 = Base plate

- Before the trigger box is fitted, its base plate must be coated with thermal conduction paste. Only use an appropriate object to apply the paste (screwdriver, matchstick etc.). Thermal conduction paste is not to come into contact with painted surfaces.



- 1 = Spark gap
- 2 = 5 kΩ sleeve-type suppressor
- 3 = Ignition coil

Danger arrows = dangerous voltages
(400 V - 25 kV)

- In order to prevent the trigger box from being irreparably damaged, when using a spark gap, an interference-suppression resistor of at least 2 kΩ must be connected between the spark gap and ignition coil terminal 4, e.g. sleeve-type suppressor (5 kΩ) 0 356 500 001.
- In the case of ignition distributors with engine-speed limitation the ignition distributor side terminal 4 must have 1 kΩ interference suppression.
Operation without interference suppression will lead to the destruction of the trigger box.



- In order to prevent the trigger box from being irreparably damaged, the secondary side of the ignition system must have at least 2 k Ω interference suppression whereby the original distributor rotor with 1 k Ω interference-suppression resistor must be fitted (even in the case of radio and spark interference suppression do not use a 5 k Ω distributor rotor).
- No external voltage e.g. ohmmeter may be connected to the ignition pulse generator. Caution when switching measuring range.
- The holding springs of the distributor cap must not drop into the pickup system when the engine is being cranked and with the dust-protection cover removed.
- Arcing and flashover at ignition-distributor cap (poor insulation) may destroy ignition pulse generator and trigger box.
- Do not disconnect the battery while the engine is running.
- Incorrect polarity of battery will destroy ignition pulse generator, trigger box and ignition coil.
- Do not use a starting aid with more than 16 V or a fast charger for starting.



- The specified ignition coil (see Part No.) must not be replaced with a different ignition coil.
- No suppression capacitor may be connected to ignition coil 1.
- Ignition coil terminal 1 must not be brought into contact with ground as a theft-proofing measure (ignition coil will be destroyed when ignition is switched on).
- No battery + or test lamp must be connected to ignition coil terminal 1 (trigger box will be destroyed).
- Ignition cable from ignition coil terminal 4 to ignition distributor terminal 4 must not be disconnected during operation.
- There must be no arcing between ignition coil term. 4 and ignition coil term. 1 and 15. Ignition pulse generator and trigger box may be destroyed.



10. Trouble-shooting

10.1 How to use trouble-shooting chart

The trouble-shooting chart starting on Coordinate B3 contains customer complaint (fault symptoms), cause of trouble, test instructions and coordinate references. Choose the possible cause of the trouble from the trouble-shooting chart in accordance with the customer complaint (fault symptom).

If the cause of the trouble is not clear, start testing with the detailed and self-contained trouble-shooting program starting on Coordinate B7.

If the cause of the trouble has been clearly detected as per trouble-shooting chart, direct trouble-shooting is possible by way of the Coordinate reference without having to go through the entire trouble-shooting program for each fault.

If there is no Coordinate reference on right, perform trouble-shooting in accordance with "Test instructions" column.



10.2 How to use trouble-shooting program

Procedure

The trouble-shooting program is divided into 3 rows of boxes.

The left-hand row contains test instructions and test specifications.

The center row contains repair instructions.

The right-hand row contains the illustrations/terminal diagrams belonging to the text and the explanation of the items in the picture.

If the questions asked in the left-hand row can be answered conclusively with "Yes", then proceed to the next test down.

If the answer to the question is "No", branch to the center row and carry out the tests given there.

10.3 Before testing, make sure of the following

Battery fully charged, fuel system O.K., engine mechanically O.K. (e.g. compression, valve clearance etc.). Ambient temperature/ignition system temperature 0° to +100°C (temperature has a considerable effect on measured values).



10.4 Trouble-shooting chart

Customer complaint (fault symptom)

1. Starting motor operates, engine fails to start
2. Rough idle
3. Poor throttle take-up (flat spot on acceleration)
4. Unsatisfactory engine power
5. Misfiring
6. Fuel consumption too high
7. Engine pinging when accelerating
8. Backfiring
9. Engine overheating

										Cause of trouble	Test instructions	Coordinates
•	•	•	•	•	•		•			Spark plugs defective	Assess by ignition oscilloscope pattern or visual inspection with spark plug removed	--
•	•	•	•	•	•	•	•	•		Ignition timing incorrect	See Autodata test specifications	--
•	•	•	•	•						Shunt on secondary side	Assessment of ignition coil, ignition distributor, ignition harness and spark plug by ignition oscilloscope pattern/visual examination	--
•	•	•	•	•						Open circuit on secondary side	Assessment of ignition coil, ignition distributor, ignition harness and spark plug by ignition oscilloscope pattern, or continuity check with ohmmeter	--
		•	•	•	•					Interference-suppression resistors defective	Assessment by ignition oscilloscope pattern/resistance measurement.	--
	•	•	•		•	•	•	•		Centrifugal advance incorrect	See Autodata test specifications	--
		•	•		•	•		•		Vacuum advance incorrect	See Autodata test specifications	--

B3

Trouble-shooting chart
Volkswagen



B4

Trouble-shooting chart
Volkswagen



Trouble-shooting chart

Customer complaint (fault symptom)

- |1. Starting motor operates, engine fails to start
- |2. Rough idle
- |3. Poor throttle take-up (flat spot on acceleration)
- |4. Unsatisfactory engine power
- |5. Misfiring
- |6. Fuel consumption too high
- |7. Engine pinging when accelerating
- |8. Backfiring
- |9. Engine overheating

									<u>Cause of trouble</u>	<u>Test instructions</u>	<u>Coordinates</u>
•	•	•	•	•					Engine-speed limiter (if fitted) defective	Check cutoff speed/visual examination.	--
•									Firing sequence incorrect	See Autodata test specifications	--
•	•	•	•	•					Ignition coil defective	Visual inspection, electrical test	B 12 C 9
•									Trigger box defective	Check peak-coil-current cut-off	B 18
				•					Trigger box defective	Check primary voltage	B 18
•									Open circuit on primary side	Check trigger box/primary circuit power supply	C 1
•									Ignition pulse generator defective	Ignition pulse generator voltage and control leads, ignition pulse generator, power supply, operation of ignition pulse generator	C 3 C 5 C 7

B5

Trouble-shooting chart
Volkswagen



B6

Trouble-shooting chart
Volkswagen



10.5 Beginning of trouble-shooting program

Starting motor operates, engine fails to start
or misfires or lacks power.

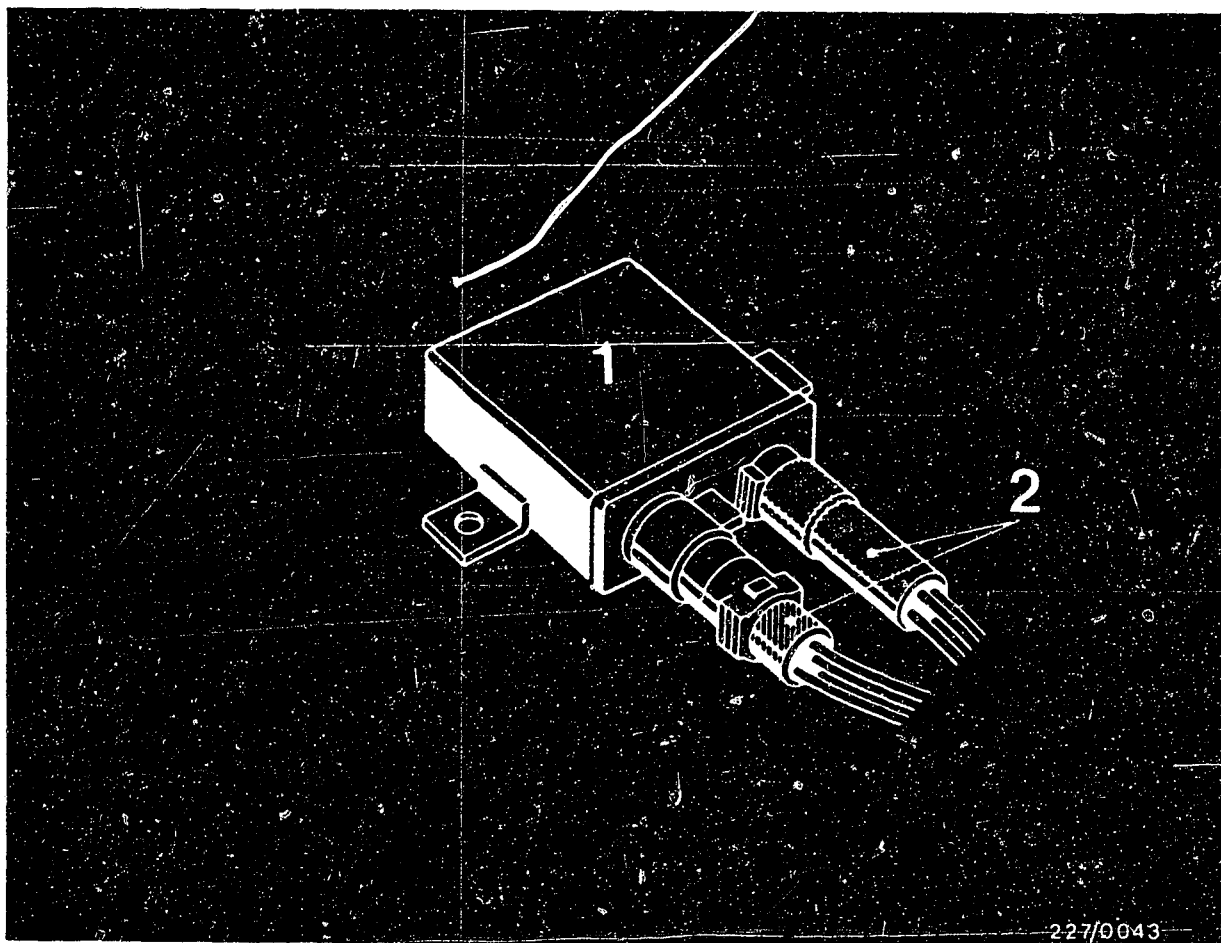
Yes

Continued on B 8

B7

Trouble-shooting program
Volkswagen





1 = DLS unit
2 = DLS connector

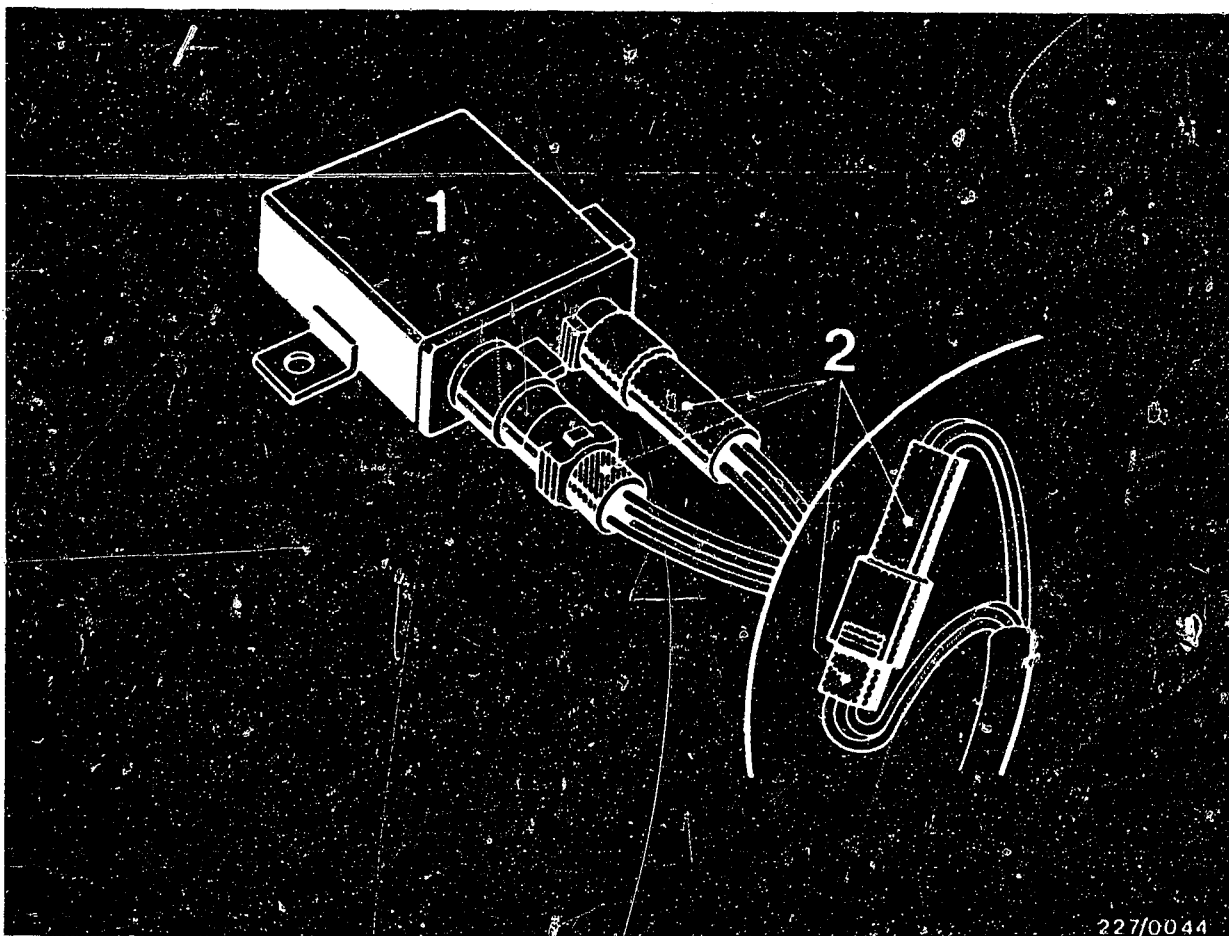
Yes

Test plug of DLS unit - if fitted.

Visual examination: Remove both plugs from DLS unit (see illustration) and check contacts for oxidation and secure fastening (remedy defects). Plug both plugs back onto the DLS unit. If customer complaint not remedied, continue testing.

Yes

Continued on B 9



227/0044

↓ Yes

Render DLS unit (if fitted) inoperative.

Remove both plugs from DLS unit (2) and join together (see illustration). If customer complaint now remedied replace DLS unit. If customer complaint not remedied, continue testing.

↓ Yes

Continued on B10/B11

B9

Trouble-shooting program
Volkswagen



yes

Test primary signal. If no oscilloscope or tachometer available, check whether ignition spark across spark gap.

Primary signal testing with oscilloscope

Connect oscilloscope to ignition coil as per operating instructions.

Start engine.

Oscilloscope must indicate a primary voltage (of any value).

Primary signal testing with tachometer

Connect tachometer to ignition coil as per operating instructions.

Start engine.

Tachometer must indicate a reading (of any value).

Ignition spark testing with spark gap

Remove H.T. ignition cable term. 4 from ignition coil.

Connect spark gap including sleeve-type suppressor (5 k Ω) to ignition coil. Adjust spark gap to 5 mm.

Start engine.

There must be sparks across the spark gap.

Primary signal present or ignition sparks across spark gap?

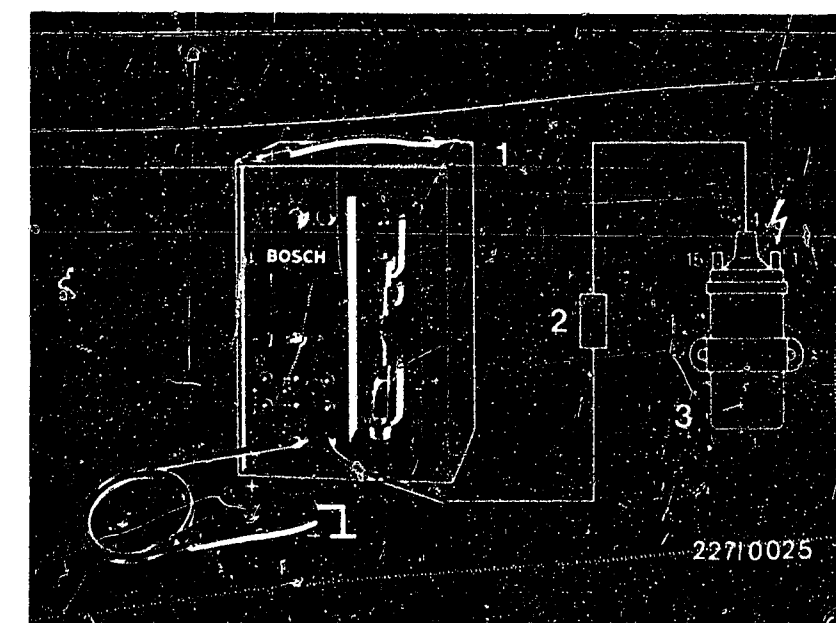
yes

Continued on B12/B13

no

If no primary signal or no ignition spark, continue testing at C 1.

Tests from B 7 onwards not necessary.



1 = Spark gap

2 = 5 k Ω sleeve-type suppressor

3 = Ignition coil

Danger arrows =
Dangerous voltages
(400 V-25 kV)

B10

Trouble-shooting program

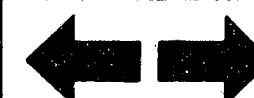
Volkswagen

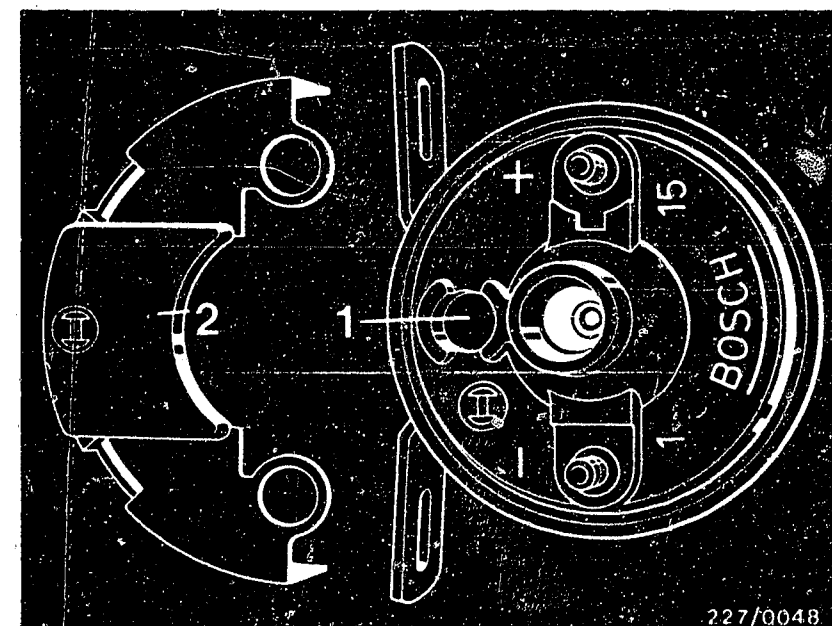
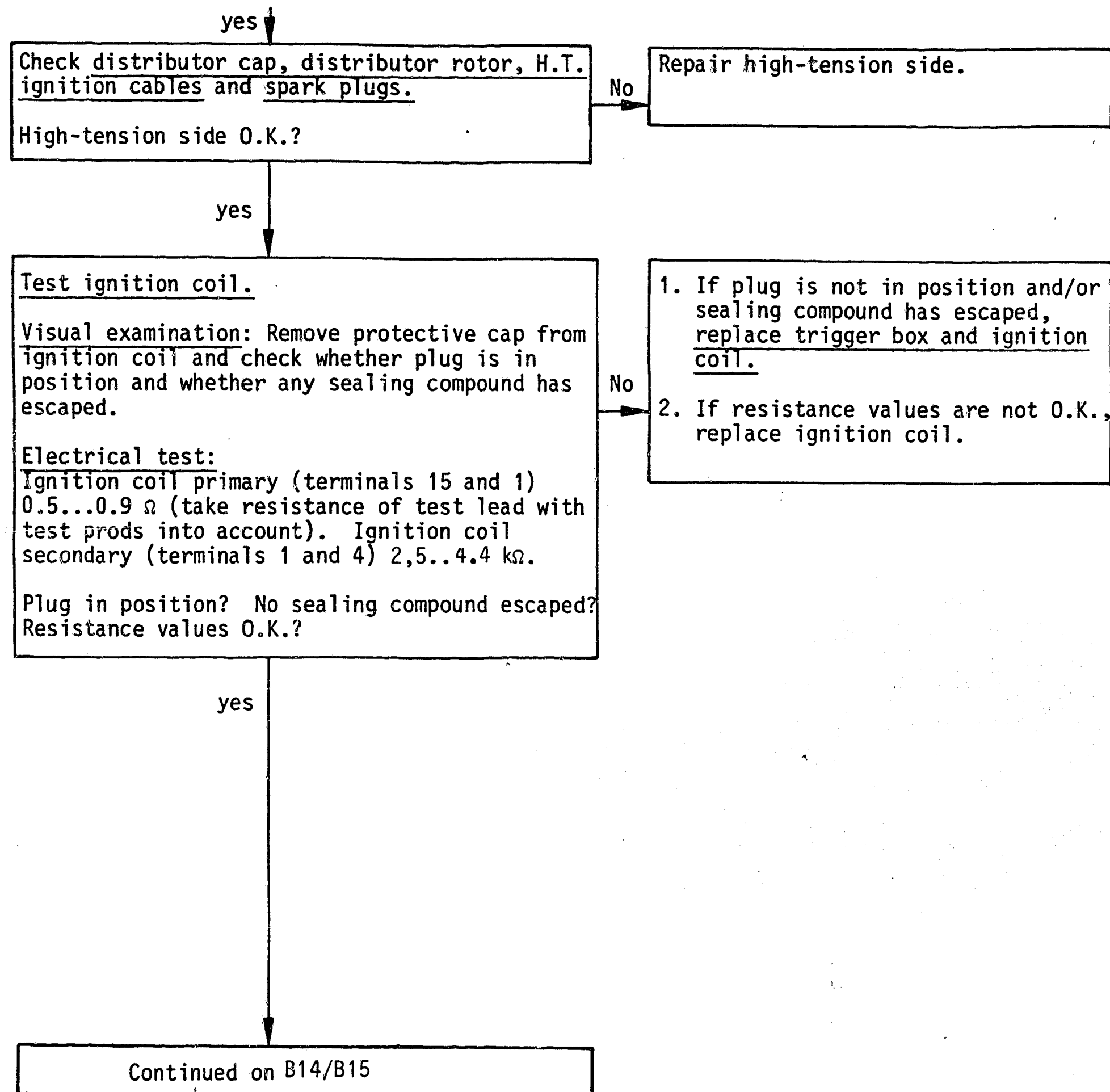


B11

Trouble-shooting program

Volkswagen





1 = Plug
2 = Protective cap

B12

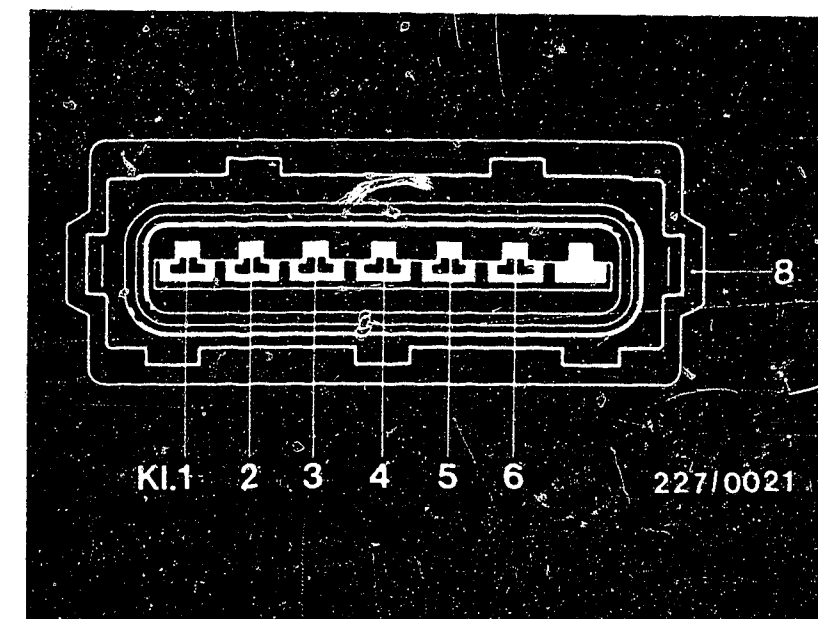
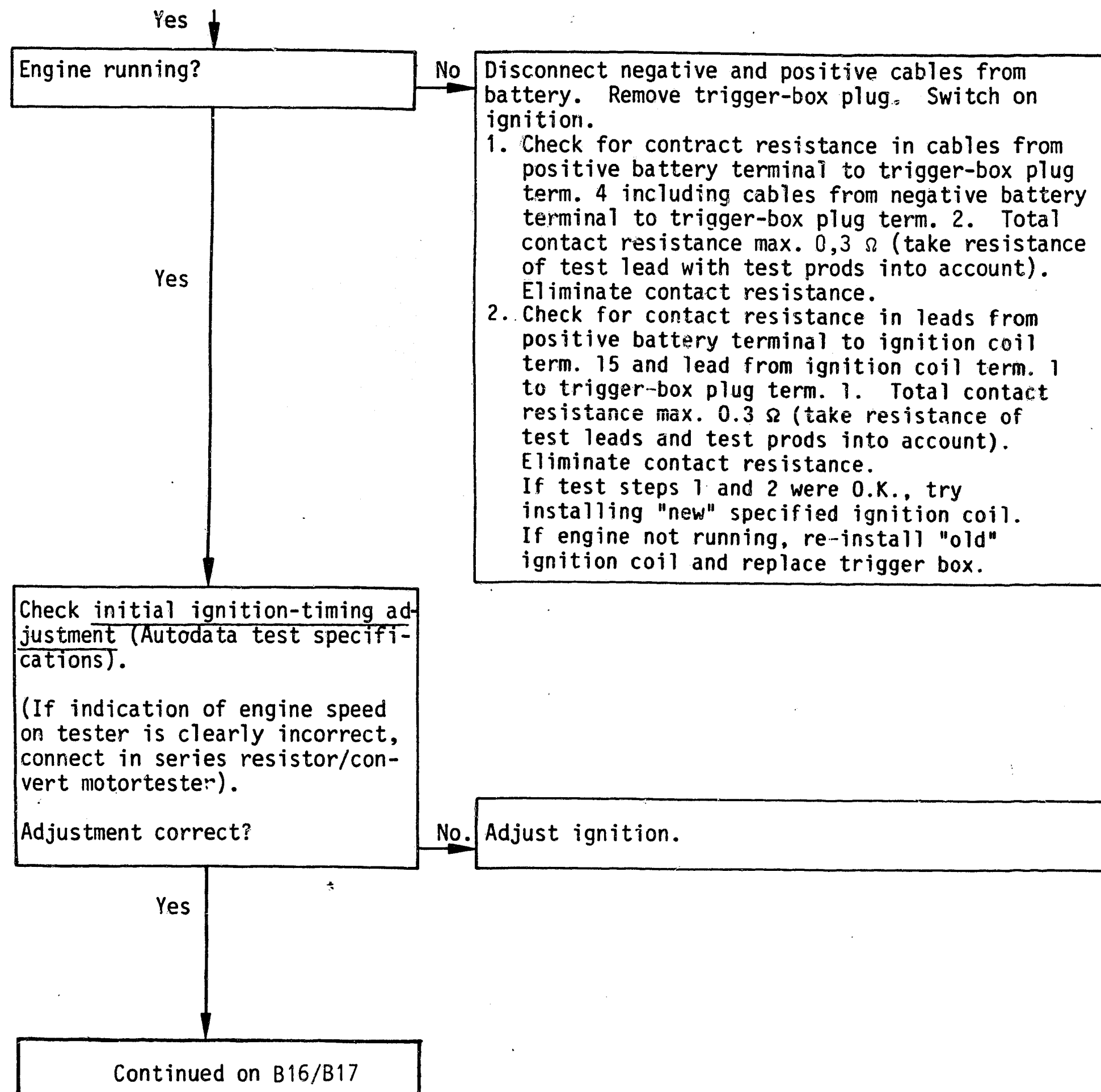
Trouble-shooting program
Volkswagen



B13

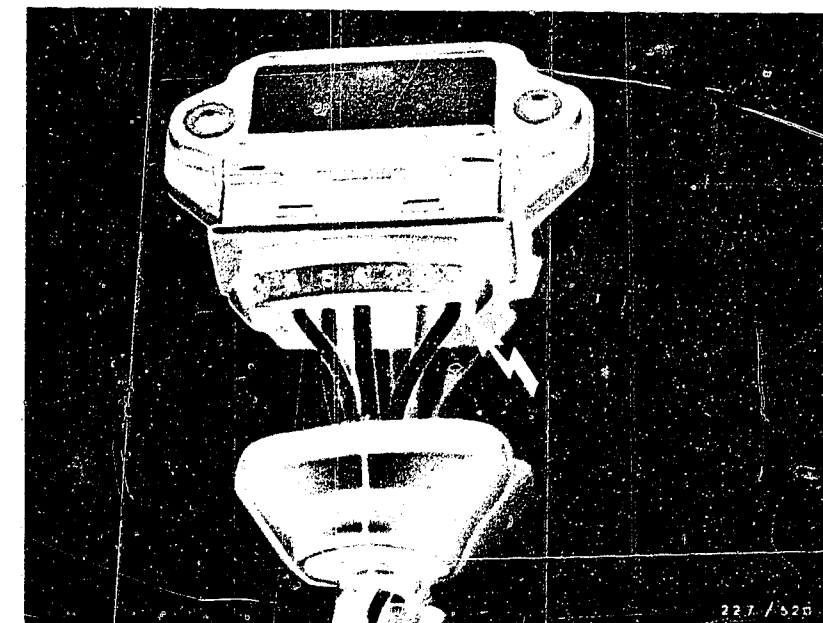
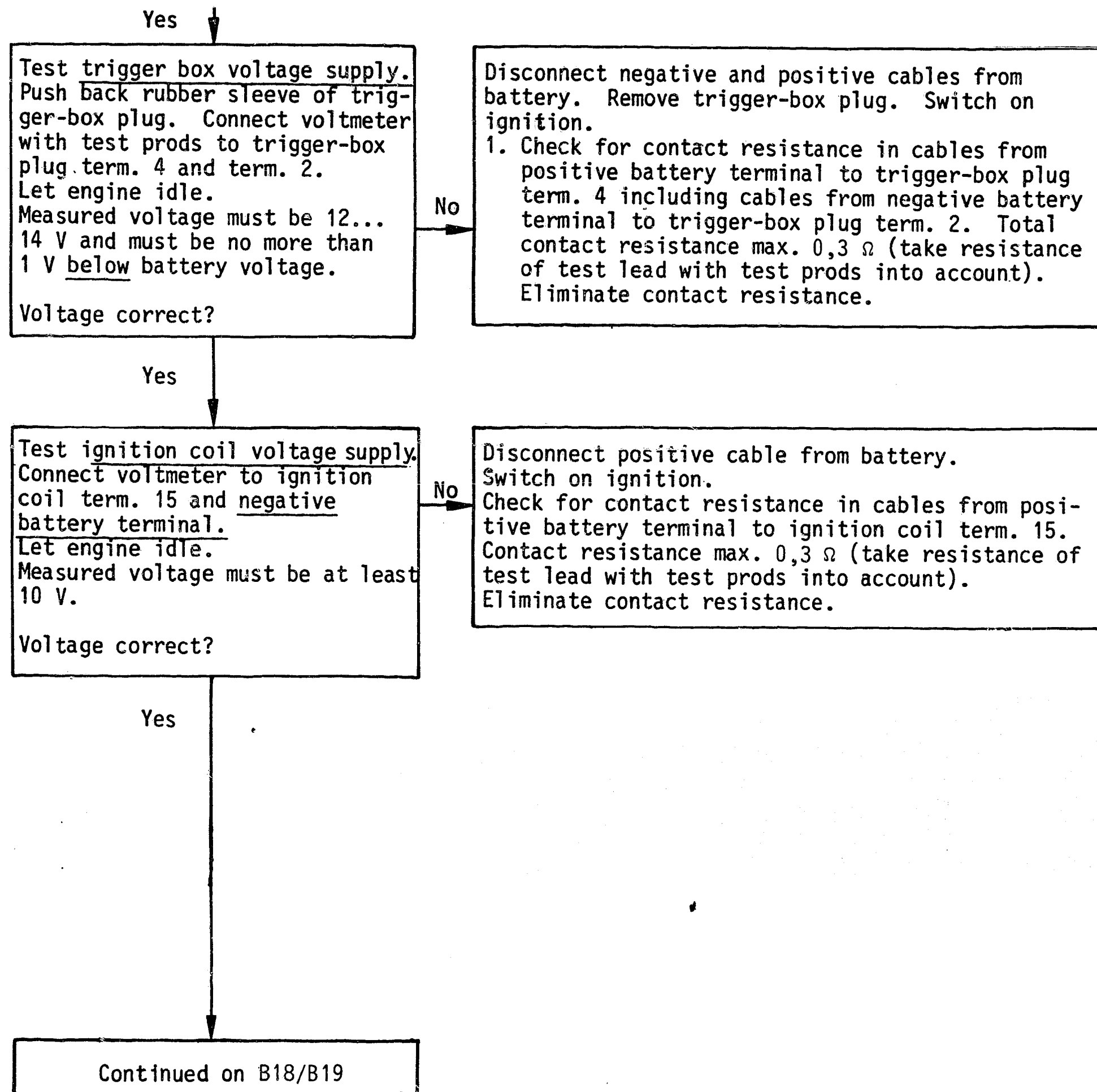
Trouble-shooting program
Volkswagen





1 = Trigger-box plug





Trigger box with connector



yes

Check peak-coil-current cut-off.

Connect voltmeter to ignition coil term. 15 and term. 1. Remove distributor cap, distributor rotor and dust-protection cover. Turn over engine by hand in direction of rotation until trigger wheel is fully in air gap of ignition pulse generator.

See top diagram.

Switch on ignition.

The voltmeter may show a brief deflection (approx. 5 V) for approx. 1 s. Voltmeter must return to 0 V.

Voltage (0 V) correct?

no

Replace trigger box and ignition coil.

yes

Check primary voltage

(if MOT series available).

Connect oscilloscope (e.g. MOT 201) to ignition coil as per operating instructions together with pulse shaper 1 684 463 154.

Note: Incorrect reading without pulse shaper.

Run engine at idle.

The measured primary voltage must be 340...390 V.

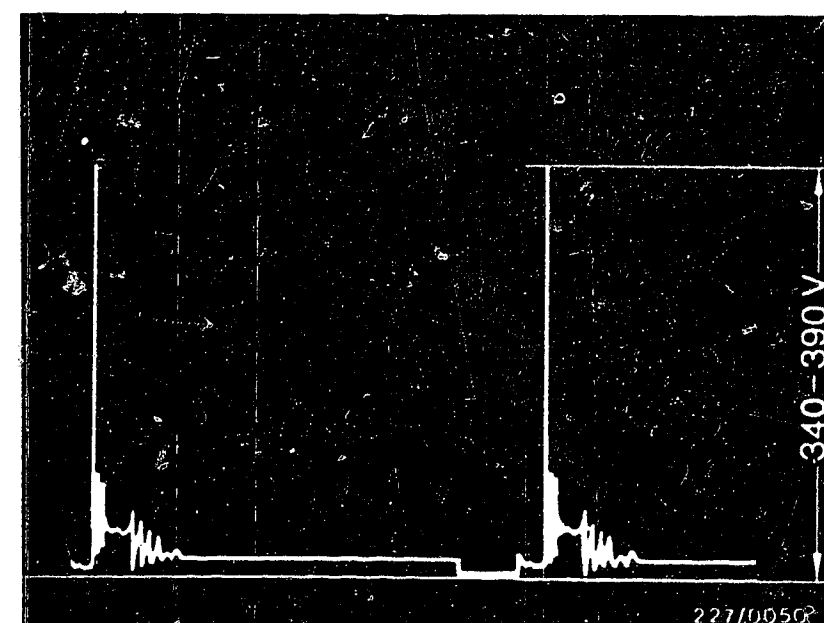
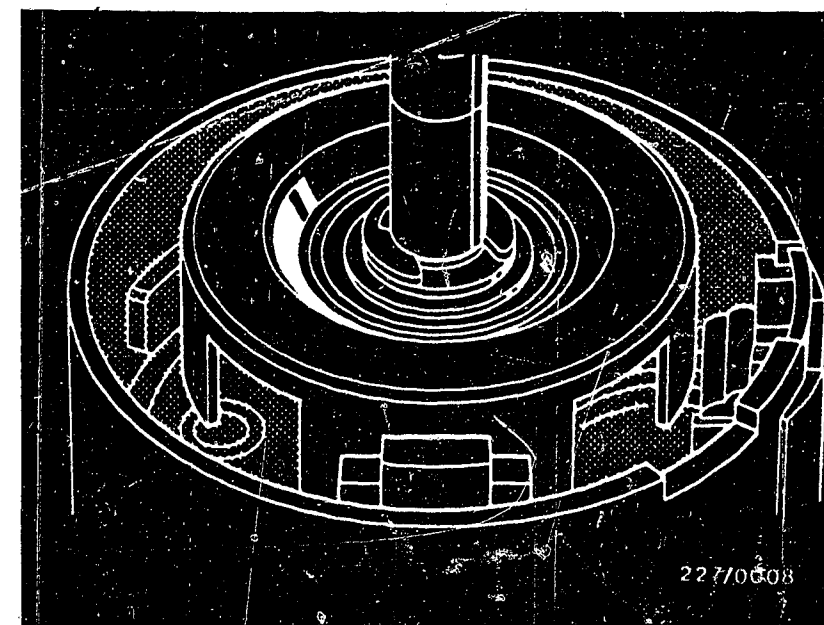
See bottom graph.

no

Replace trigger box.

yes

Continued on B20



B 18

Trouble-shooting program

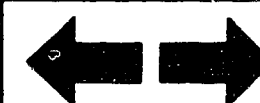
Volkswagen

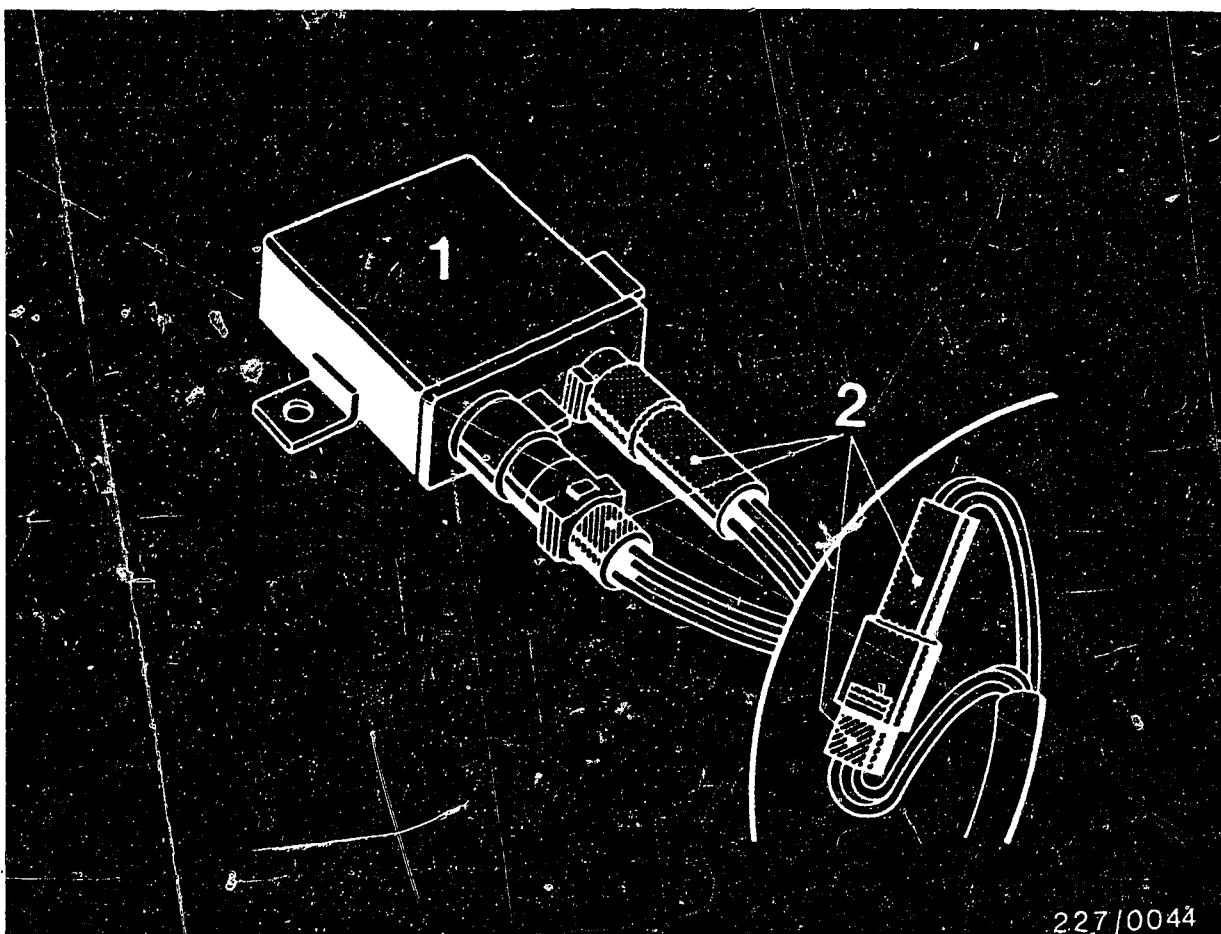


B 19

Trouble-shooting program

Volkswagen





227/0044

1 = DLS unit
2 = DLS connector

If all test steps were O.K. and customer complaint still not remedied, try installing "new" specified ignition coil.

If customer complaint still not remedied, re-install "old" ignition coil.

Ignition system O.K. Take DLS connectors apart again and plug onto DLS unit. See picture.

Tests starting on C1 not necessary.

Note: If customer complaint still not remedied, further possible faults on fuel system, or engine not mechanically O.K.

10.5.2 No primary voltage/no ignition spark.

(Continued from B 5/B 6)

yes

Check trigger box power supply.
Disconnect trigger-box plug and connect voltmeter to term. 4 (+) and term. 2 (-), see picture. Switch on ignition. The voltmeter must indicate battery voltage.

Voltage correct?

No

Check for open circuit in cables and terminals from ignition and starting switch to trigger-box plug term. 4 including ground cable term. 2. Eliminate open circuit.

yes

Check primary circuit.
Connect voltmeter to disconnected trigger-box plug at term. 1 (+) and term. 2 (-). See picture. Switch on ignition. The voltmeter must indicate battery voltage.

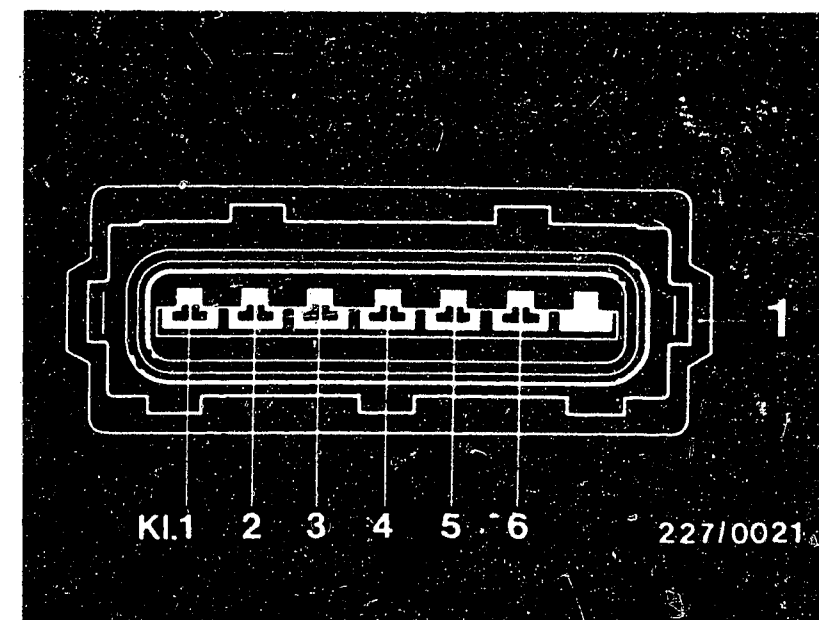
Voltage correct?

No

Check for open circuit in cable from ignition and starting switch to ignition coil term. 15, primary winding of ignition coil as well as cable from ignition coil term. 1 to trigger-box plug term. 1 including ground cable term. 2. Eliminate open circuit.

yes

Continued on C 3/4



1 = Trigger-box plug

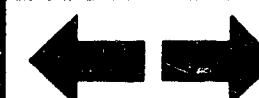
C1

Trouble-shooting program
Volkswagen



C2

Trouble-shooting program
Volkswagen



yes

Check voltage and control leads of ignition pulse generator.

Disconnect ignition-distributor plug.
Connect ohmmeter with test prods in turn to:

Ignition-
distributor plug

Trigger-box plug

Term. 5 and
Term. 3 and
Term. 6 and

term. 5
term. 3
term. 6

Ohmmeter must indicate approx. 0 Ω
(continuity) in each case.

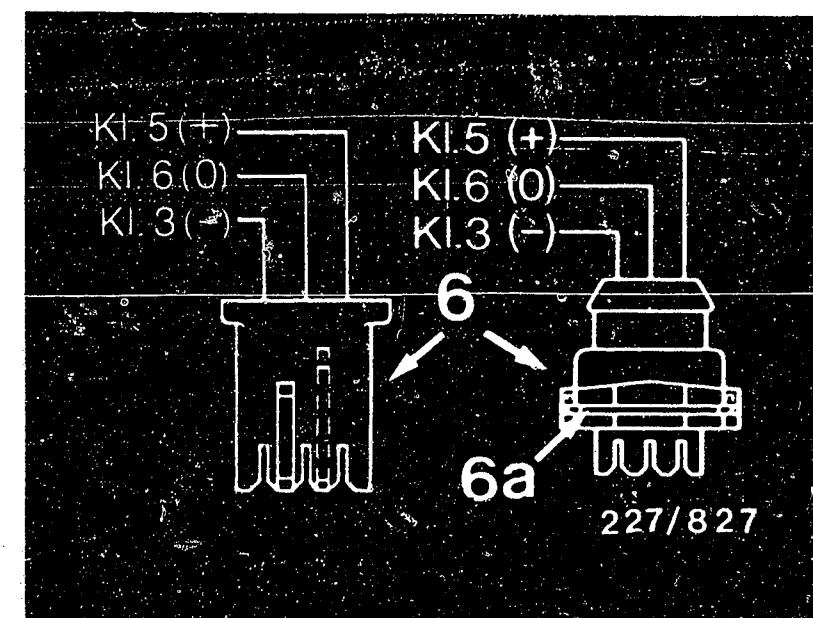
O.K.?

no

Eliminate open circuit.

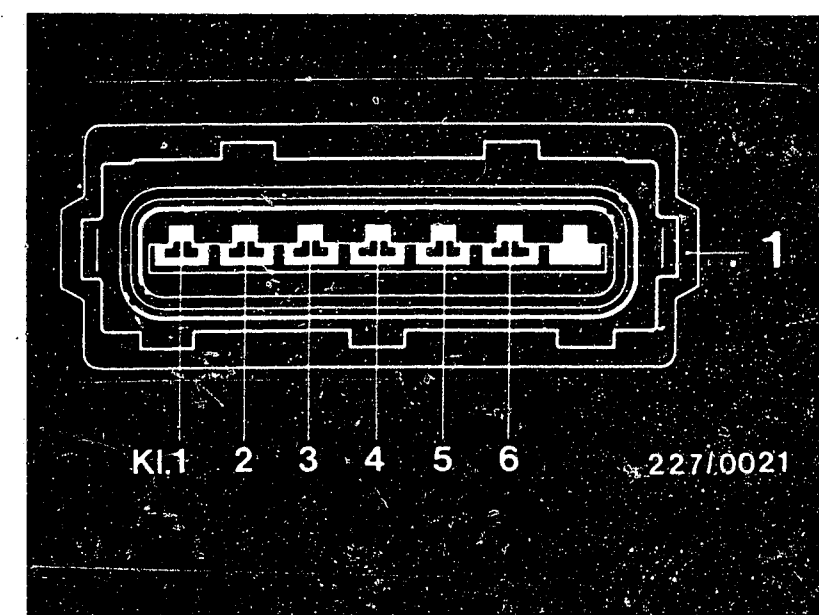
yes

Continued on C5/C6



6 = Ignition-distributor plug
Left - old version with
guide lugs
right - new version
6a = Wire retainer

1 = Trigger-box plug



C3

Trouble-shooting program
Volkswagen



C4

Trouble-shooting program
Volkswagen



yes

Check ignition pulse generator power supply

Connect trigger-box and ignition-distributor plugs.

Push back rubber sleeve on ignition-distributor plug.

Connect voltmeter with test prods at term. 5 (-) and term. 3 (+).

Switch on ignition.

The measured voltage must be at least 10 V.

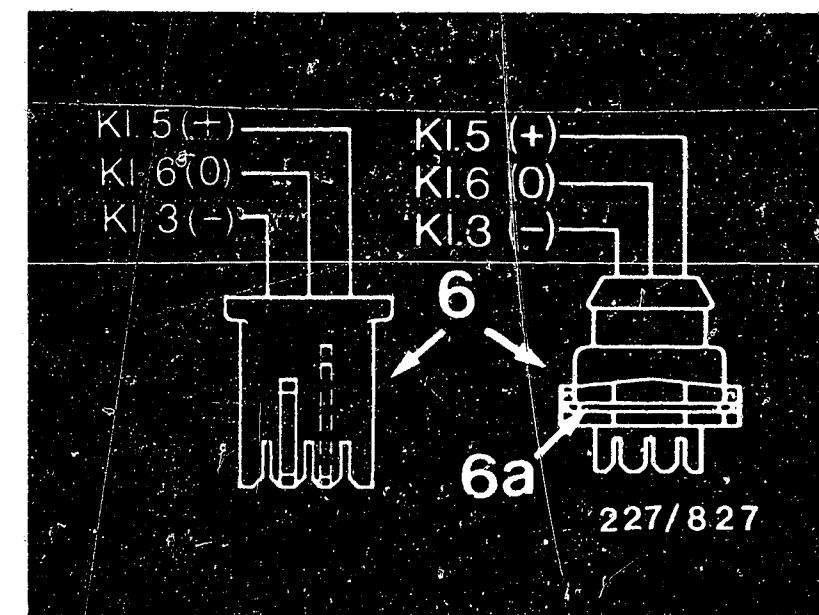
Voltage correct?

no

Replace trigger box.

yes

Continued on C7/C8



6 = Ignition-distributor plug
left - old version with
guide lugs,
right - new version
6a = Wire retainer

C5

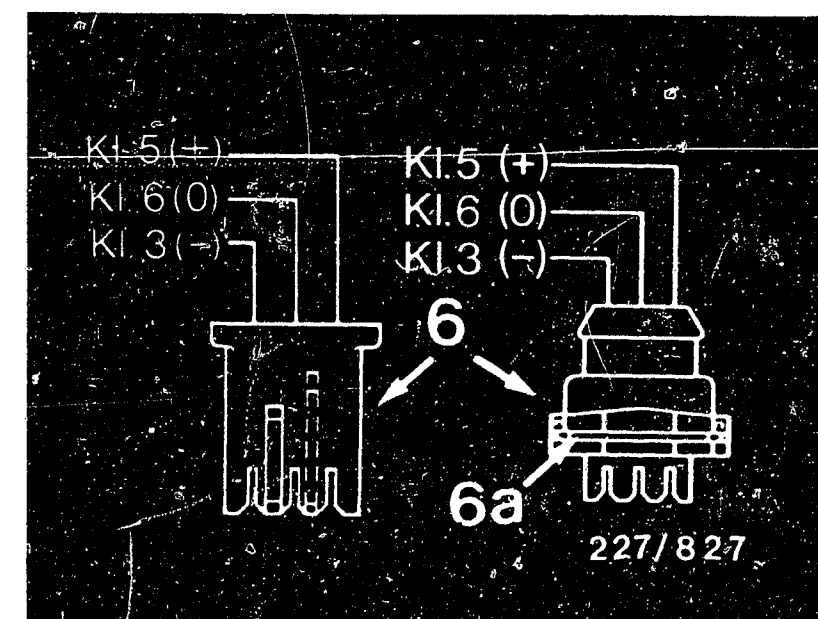
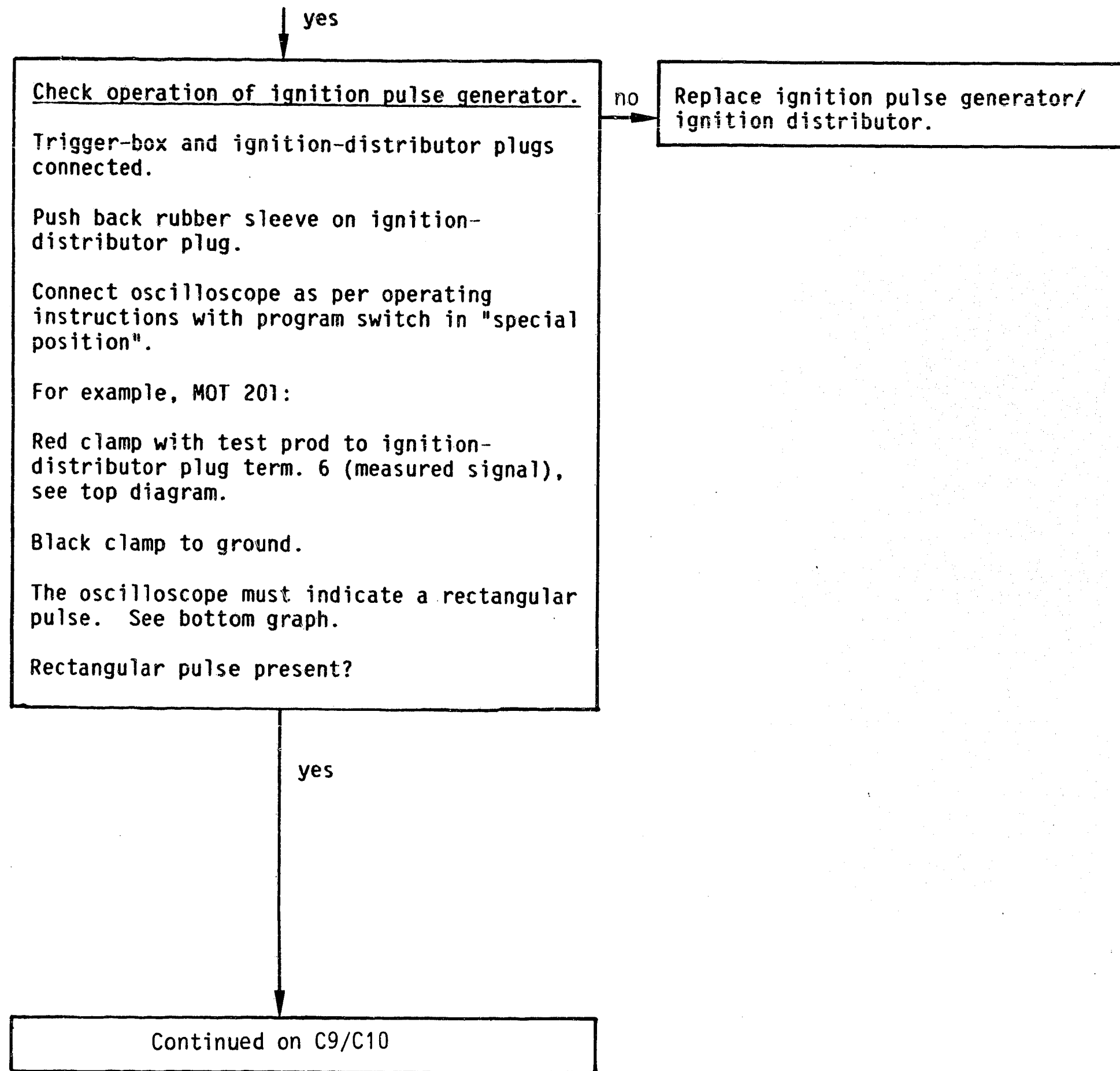
Trouble-shooting program
Volkswagen



C6

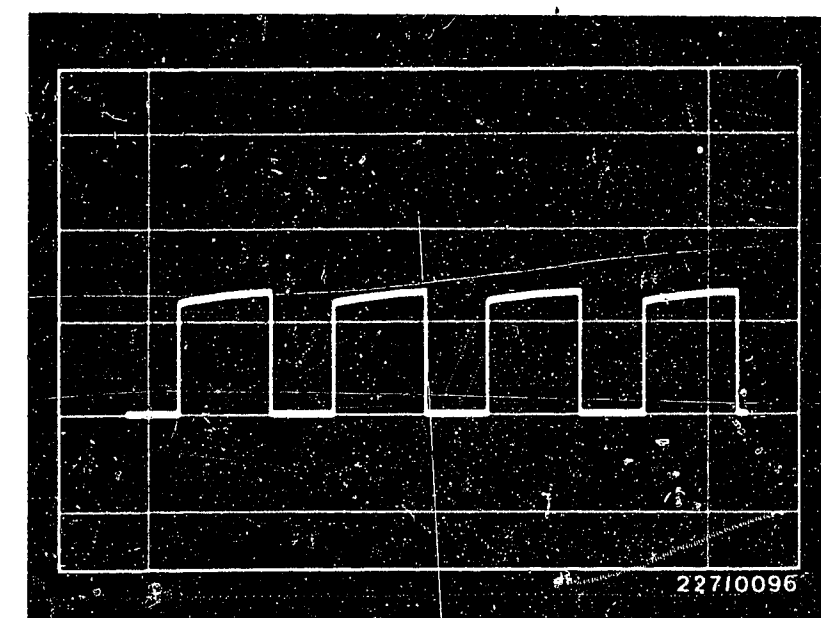
Trouble-shooting program
Volkswagen





6 = Ignition-distributor plug
left - old version with
guide lugs,
right - new version
6a = Wire retainer

Rectangular pulse



C7

Trouble-shooting program
Volkswagen



C8

Trouble-shooting program
Volkswagen



yes

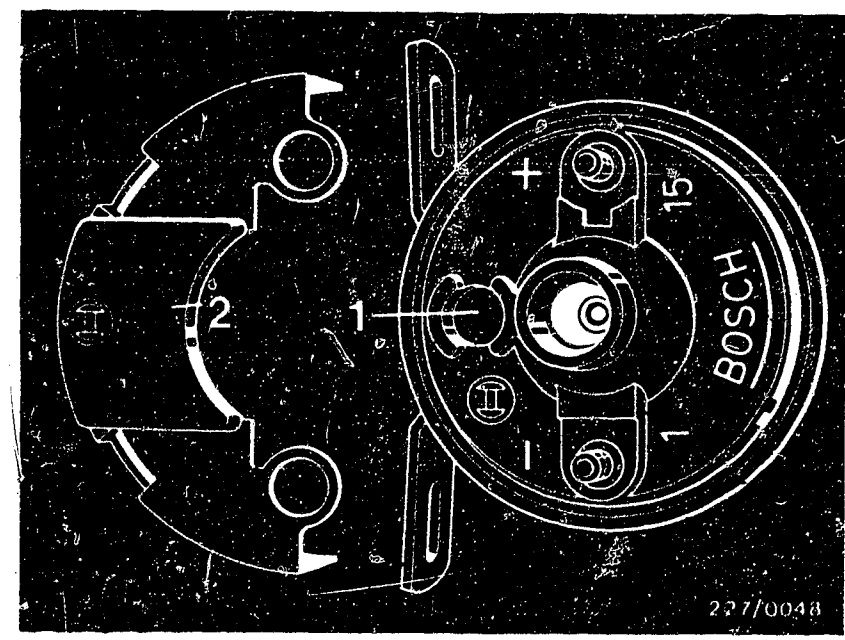
Check ignition coil.

Visual inspection: remove protective cap from ignition coil and check that plug (see picture) is present and that no sealing compound has escaped.

Electrical test
Ignition coil, primary (term. 1 and term. 15)
0.5...0.9 Ω (take resistance of test leads and test prods into account).
Ignition coil, secondary (term. 1 and term. 4)
2.5...4.4 k Ω .
Plug present/no sealing compound escaped?
Resistance values correct?

no

1. If plug not present/sealing compound has escaped, then replace trigger box and ignition coil.
2. If resistance values not correct, then replace ignition coil.



1 = Plug
2 = Protective cap

yes

Continued on C11/C12

C9

Trouble-shooting program
Volkswagen



C10

Trouble-shooting program
Volkswagen



↓ yes
Continued

If all test steps were O.K. and still no primary signal/no ignition spark, try installing "new", specified ignition coil. If still no primary signal/ignition spark, re-install "old" ignition coil and replace trigger box.

Testing completed.

Tests from B7 not necessary.

Note:

If customer complaint still not remedied, further possible faults on fuel system, or engine not mechanically O.K.



After-sales Service

Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

22

Danger of Accident on Semi-conductor Ignition Systems

VDT-I-227/102 B

11.1976

Please be sure to pass this bulletin on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufactures starting to equip their vehicles with semi-conductor ignition systems as original equipment. In most cases the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" parts or contacts (whether on the primary side or the secondary side) can prove fatal.

In this connection we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems the ignition is to be switched off. Included in such work are the following operations:

- Connection of engine testing equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacement of ignition system parts (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.).

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnostic connector), on terminals, and on test equipment.

BOSCH

Geschäftsbereich KH Kundendienst, Kfz-Ausüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

N1

Technical Bulletin

Volkswagen

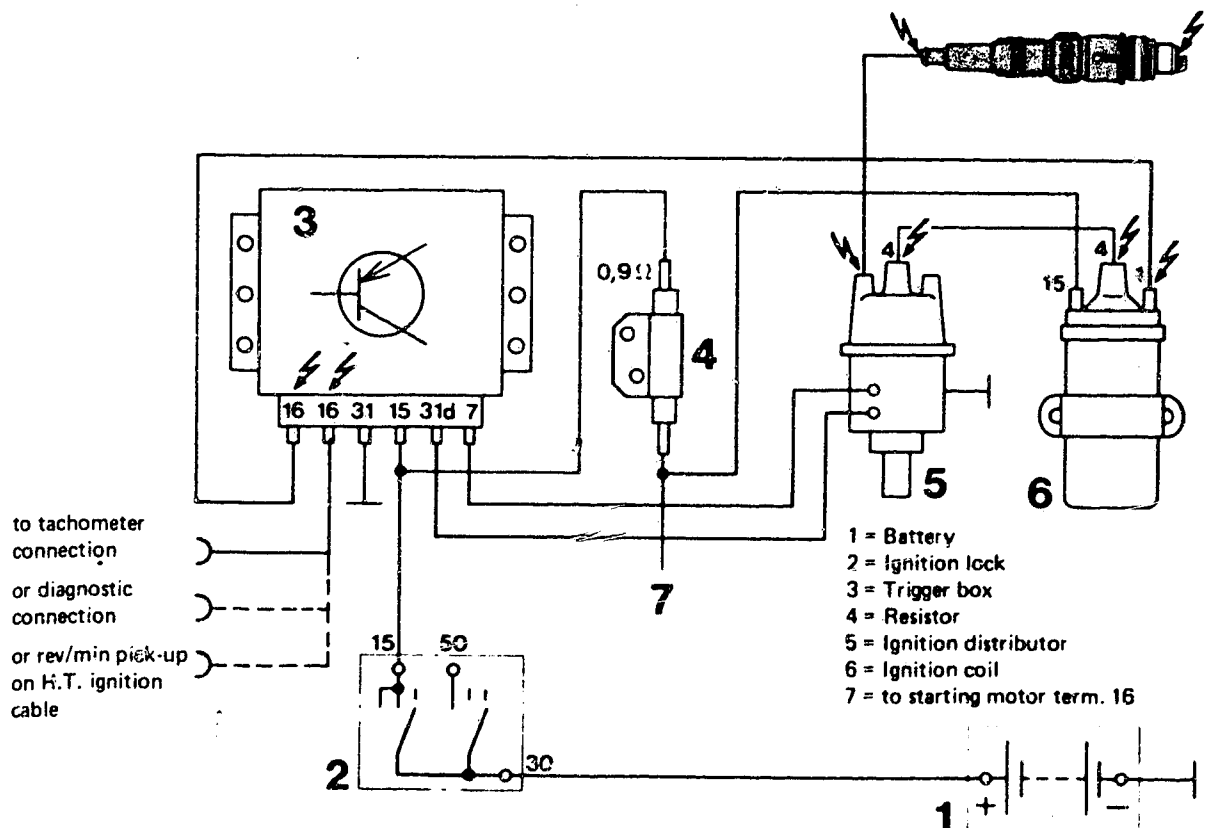


In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

- Operation of the trigger box without the ignition transformer.
- At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the danger points are marked with red high-voltage arrows. We would point out that all semi-conductor ignition systems, even the older ones, are to be regarded as dangerous in the sense as defined by this bulletin.

Please address any queries or comments concerning the contents of this publication to our representative in your country.



Terminal diagram

After-sales Service

Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

EFFECTS OF ELECTRICAL AND ELECTRONIC
SYSTEMS ON HEART PACEMAKERS

VDT-I-227/107 En

1.1981

e.g. ignition systems, Jetronic, Motronic, ABS

Please ensure without fail that this Bulletin is passed on to your employees for their attention!

We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of an examination carried out by the Ignition System Development Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Central Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co. of Berlin, a manufacturer of heart pacemakers. The magazine "Biomedizinischen Technik" (5/80) listed the results.

The most important discoveries in this practice can be summarized from the examination report as follows:-

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.
2. With a stationary engine and the ignition switched off the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.
3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency).
Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers please carry out the necessary measures.

BOSCH

Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

N3

Technical Bulletin -

Volkswagen



We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.



After-sales Service

Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party

BREAKERLESS TRANSISTORIZED IGNITION SYSTEM

22

Warranty note

VDT-I-227/103 En

Hybrid construction trigger boxes

3.1979

0 227 100 100 for ignition distributor
with Hall generator (TCI-h)
0 227 100 102 for ignition distributor
with induction-type
pulse generator (TCI-i)

Apart from the well-known TCI trigger boxes 0 227 100 0.., trigger boxes of hybrid construction have been fitted as standard since 9.78 (Fig. 1).

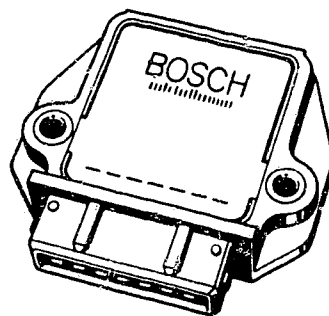


Fig. 1

Warranty procedure

If the complaints are justified, all these hybrid trigger boxes are to be sent, along with completed warranty documents, to your authorized representative for forwarding to the following address:

ROBERT BOSCH GMBH
KH/LAV - Auspackraum

zur Weiterleitung an K1/VAK 21

D-7000 Stuttgart 30

This instruction remains valid until further notice.

BOSCH

Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

N5

Technical Bulletin

Volkswagen



After-sales Service

Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party

NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En

1.1983

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Coil ignition	SZ (CI)	-----	Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I* (TCI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
	TSZ-H	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized ignition	TZ-I* (TI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in Hybrid technique)	TZ-H* (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)

BOSCH

Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

N6

Technical Bulletin

Volkswagen



Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Breakerless semiconductor ignition with or without knock control	EZ EZ-K	- K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributorless ignition with or without knock control	VZ VZ-K	- K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

*Note: The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).



After-sales Service

Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party.

INCORRECT DISPLAY OF ROTATIONAL SPEED AND
DWELL ANGLE ONLY WITH TRIGGER BOXES
0 227 100 ... (TCI-i, TCI-h) WITH CURRENT
LIMITATION

VDT-I-Gen. 030 En
6.80
Supersedes Ed. 3.80

For additional information see VDT-I-Gen. 032 En

1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00 }	Rotational-speed	KTE 001.00
001.01 }	display O.K. with these	001.02
001.02	testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild-ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan-Datsun	(Hitachi ignition system)
Fiat	(Delco ignition system)	Peugeot	(Bosch ignition system)
Ford	(Delco ignition system)	VW	(Bosch/Fairchild ignition system)
General-Motors	(HEI-ignition system)	Bosch transistorized ignition system for retrofitting 0 227 100 920	

BOSCH

Geschäftsbereich KM Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1 Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

N8

Motor Vehicle Service Information
Volkswagen



2. Test instructions

2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min⁻¹ to 1200 min⁻¹).

It is, however, possible to attain correct rot.-speed measurements as follows:

Connect a ballast resistor of 0.9 or 1.0 Ohm (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

Suggestion for user manufacture

Required parts:

- 1 ballast resistor 0.9 Ohm
- or
- 1 ballast resistor 1.0 Ohm
- 2 blade receptacles e.g.
- approx. 0.2 m cable, 1.5 mm² e.g.
- 2 insulated clips

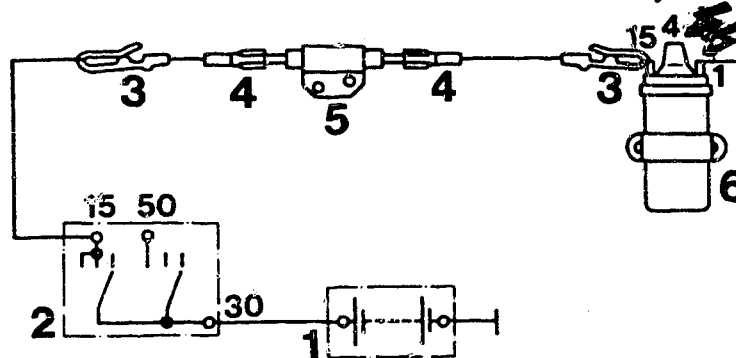
Part No. 0 227 900 002

Part No. 0 227 900 101

Part No. 1 901 355 881

Part No. 6 210 150 150

Commercially available



- 1 = Battery
- 2 = Ignition switch
- 3 = Clips

- 4 = Blade receptacle
- 5 = Ballast resistor
- 6 = Ignition coil

⚡ approx. 400 V

⚡ approx. 25 kV

2.2 Dwell angle

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

2.3 Ignition point

Is displayed correctly. Connect tester as per operating instructions.



After-sales Service

Motor Vehicle Service Information

Only for use within the Bosch organization Not to be communicated to any third party

MOTORTESTER CONVERSION

Incorrect display of rotational speed,
dwell angle and ignition point
only with trigger boxes
0 227 100 ... (TCI-i, TCI-h) with current
limitation

VDT-I-Gen. 032 En
6.80

For additional information see VDT-I-Gen. 030 of 6.80

Re.: Motortester EFAW 268
268 S 10
269
214 B
AE 2000

1. General

Please make sure that the above-mentioned motortesters in your workshop and at your customers (e.g. motor vehicle workshops, oil companies, gas stations, vocational schools etc.) are converted. The conversion is subject to payment and is carried out by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with fitting of switch).

2. Why motortester conversion?

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle as well as to incorrect triggering of the meter when testing the ignition system. There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing light is triggered by the signal path dwell angle - meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

3. Conversion measures

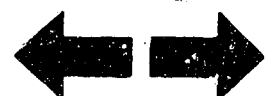
The situation is to be remedied by modifying the wiring of the testers so that the timing light is triggered by the clamp-on induction pickup and the pulse shaper stage.

BOSCH

Geschäftsbereich KH Kundendienst Kfz Ausrüstung
by Robert Bosch GmbH D-7 Stuttgart 1 Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

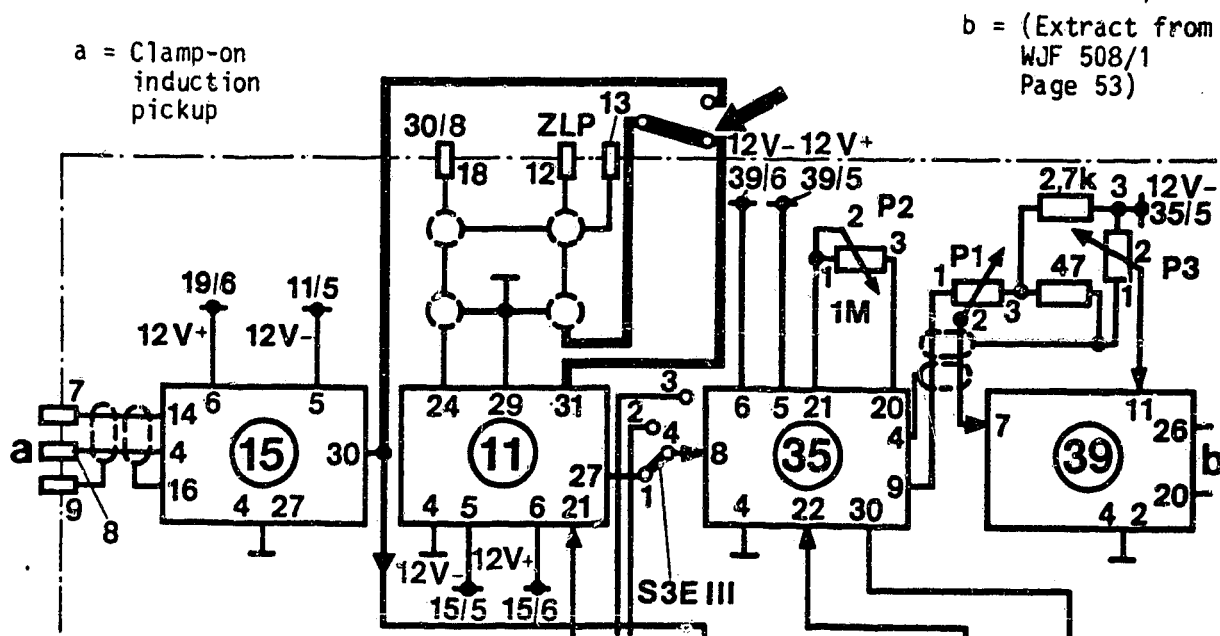
N10

Motor Vehicle Service Information
Volkswagen



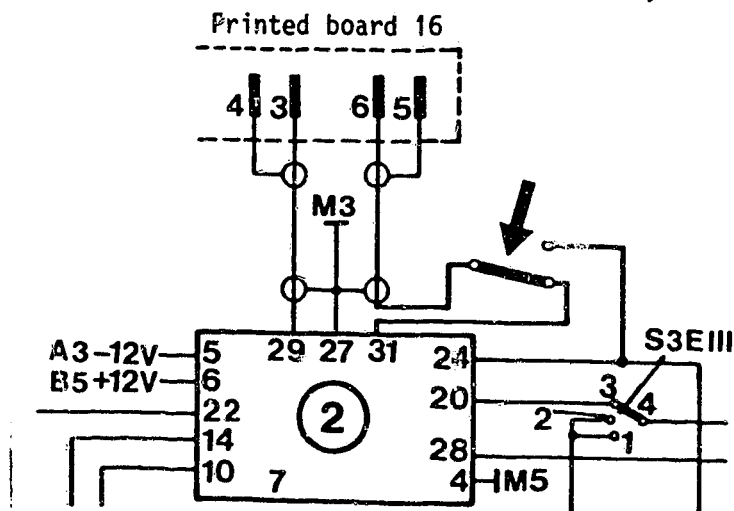
Remove the line of the ZLP* from pin 31 of printed board 11 (coupling stage) and connect to pin 30 of printed board 15 (pulse shaper stage) via a switch with change-over contact (e.g. 0 341 500 803). In addition, a new line must be connected from pin 31 of printed board 11 to the other contact of the switch with change-over contact. Arrow points to switch with change-over contact.

* ZLP = timing light



EFAW 214 B

Remove the line from terminal 6 of printed board 18 to pin 31 of printed board 2 (coupling stage) and connect to pin 24 of the same printed board via a switch with change-over contact (e.g. 0 341 500 803). In addition, a new line must be connected from pin 31 of printed board 2 to the other contact of the switch with change-over contact. Arrow points to switch with change-over contact.



By fitting the switch with change-over contact in the front panel of the motor-tester, it is possible to switch over from standard ignition systems to those with current limitation. We recommend that the switch positions be marked correspondingly: e.g. "standard" - "current limitation". These conversion measures have already been published in the K7 information sheet KJF 28/7911.



4. Test instructions

4.1 Standard ignition systems

Switch position: "standard"

All other tester connections as per operating instructions.

4.2 Ignition systems with current limitation

Switch position: "current limitation"

In order to trigger the timing light, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.



After-sales Service

Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party.

TESTS ON ELECTRONIC IGNITION SYSTEMS
(TCI, TZ)
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En
3.1981

The following tests are listed in older and current Tester operating instructions or in Trouble-shooting with the oscillograph.

- "Separate ignition coil test" (concerns EFAW 213, 214, 268, AE 2000).
- "Calculating the ignition voltage reserve" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- "Intensified insulation test" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7-Information K7-VJF 17/8012.

BOSCH

Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

N13

Motor Vehicle Service Information
Volkswagen



Table of contents

Section

Coordinates

Structure of microcard.....A	1
1. Special features.....A	2
2. Rapid diagnosis chart.....A	2
3. Test specifications.....A	8
4. Electrical terminal diagram.....A	9
5. Installation position of components....A	11
6. Necessary test equipment, auxiliaries..A	12
7. Danger of accident on electronic ignition systems.....A	13
8. Incorrect indication of engine speed, dwell angle and ignition point.....A	16
9. Important vehicle information.....A	17
10. Trouble-shooting.....B	1
10.1 How to use trouble-shooting chart.....B	1
10.2 How to use trouble-shooting program....B	2
10.3 Conditions for testing.....B	2
10.4 Trouble-shooting chart Customer complaint (fault symptom).....B	3



Table of contents (continued)

<u>Section</u>	<u>Coordinates</u>
<u>10.5 Detailed trouble-shooting program.....</u>	<u>B 7</u>
<u>Trouble-shooting program if primary</u> <u>signal/ignition sparks present</u>	
High-tension components.....	B 12
Ignition coil.....	B 12
Contact resistances (TI trigger box, ignition coil).....	B 14
TI trigger box and ignition coil power supply...	B 16
Peak-coil-current cut-off.....	B 18
Primary voltage.....	B 18
<u>Trouble-shooting program if primary signal/</u> <u>ignition spark not present.</u>	
TI trigger box power supply.....	C 1
Primary circuit power supply.....	C 1,
Pulse generator.....	C 3
Check ignition coil.....	C 9



Table of contents (continued)

<u>Section</u>	<u>Coordinates</u>
Technical Bulletin (Danger of accident).....	N 1
Technical Bulletin (Influence of electrical and electronic systems on cardiac pacemakers).....	N 3
Technical Bulletin (Warranty note).....	N 5
Technical Bulletin (New designation for ignition systems).....	N 6
Motor Vehicle Service Information (Incorrect indication of engine speed and dwell angle).....	N 8
Motor Vehicle Service Information (Motortester conversion).....	N 10
Motor Vehicle Service Information (Tests on electronic ignition systems).....	N 13



© 1986 Robert Bosch GmbH
Automotive Equipment - After-Sales Service
Department for Technical Publications KH/VDT,
Postfach 50, D-7000 Stuttgart 1.

Published by: After-Sales Service Department for
Training and Technology (KH/VSK). Press date: 6.1986.

Please direct questions and comments concerning the
contents to our authorized representative in your
country.

This publication is intended only for the Bosch
After-Sales Service Organization, and may not be
passed on to third parties without our consent.

Microfilmed in the Federal Republic of Germany. Micro-
photographié en République Fédérale d'Allemagne.

